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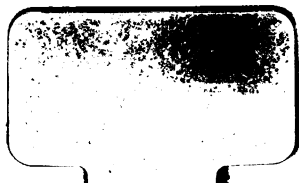
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96.

ABSTRACTS
OF
SURGICAL PRINCIPLES.

BY
THOMAS ANNANDALE, F.R.S. & F.R.C.S. (Ed.)

— ♦ —
PART I.

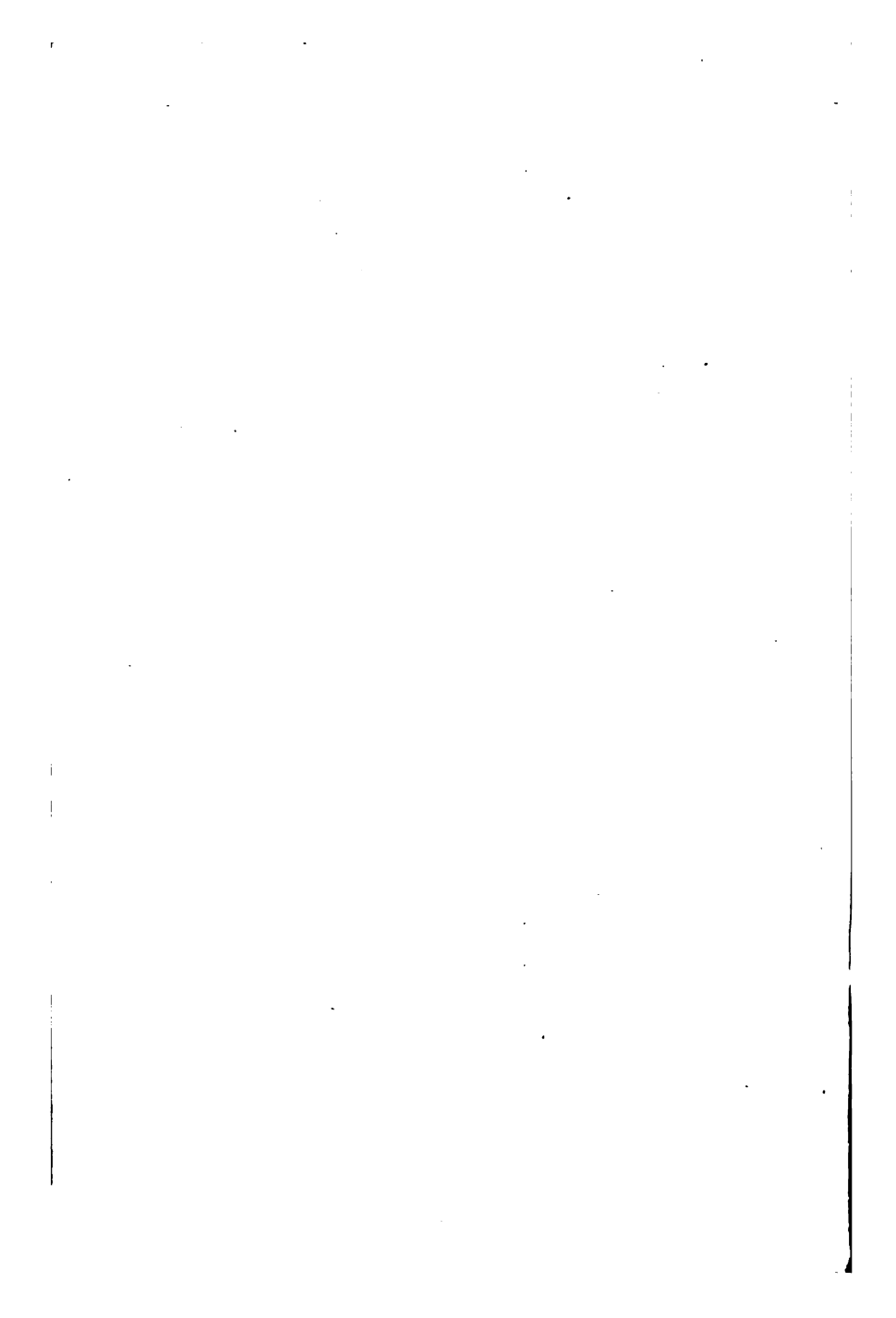
INFLAMMATION — SUPPURATION, ABSCESS, SINUS,
AND FISTULA — MORTIFICATION — ULCERATION
AND ULCERS — HEALING OF WOUNDS —
GRANULATION AND CICATRISATION.

SECOND EDITION.

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PART I.

**INFLAMMATION—SUPPURATION, ABSCESS, SINUS,
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AND ULCERS—HEALING OF WOUNDS—
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P R E F A C E.

THESE Papers were originally printed solely for the use of gentlemen attending my Class of Systematic Surgery ; but having been frequently requested to make them more public, I am induced to place them within the reach of the Medical Students of Edinburgh, with the sincere wish that they may be found an assistance in the study of some of the important principles of Surgery.

My object in preparing these Papers has been to give a concise abstract of the subjects treated of in a form intelligible to the youngest student.

It has certainly not been my intention that these Abstracts should take the place of more extended works on Surgery ; but it is my hope that a study of them will promote a better understanding of such works and their contents.

THOMAS ANNANDALE.

ABSTRACTS OF SURGICAL PRINCIPLES.

INFLAMMATION.

Composition of.

Healthy Blood.

- | | |
|------------------------|---|
| (1.) Corpuscles. | { Coloured.
Colourless. |
| (2.) Liquor Sanguinis. | { Fibrine, albumen,
and salts in solution. |

The "Serum" is the liquor sanguinis, minus the fibrine. The fibrine in living blood is in a state of solution; but when the blood is shed, or when it comes in contact with an injured or diseased surface, or tissue, or a foreign body, the fibrine coagulates.

Fibrine, when separated from the blood, is an elastic, stringy, whitish-grey substance, insoluble in water. Its microscopic structure shows a granular blastema, with a tendency to form delicate fibres, which usually assume the appearance of a delicate network.

Coagulation of.

Healthy blood, when shed, separates into—

- (1.) A fluid portion. The Serum.
- (2.) A solid clot. { Fibrine.
 { Corpuscles.

*Composition of.***Blood in Inflammation.**

Contains more fibrine, albumen, and salts.

*Phenomena of.***Inflammation.**

(1.) Increased flow of blood to the part, with dilatation of the blood-vessels. This is termed "active congestion."

(2.) Circulation at the inflamed part becomes slower and slower, round about there is still active congestion.

(3.) Circulation is stayed at the inflamed part.

(4.) Exudation of certain of the blood constituents through the walls of the blood-vessels.

When this latter occurs, one of two things may take place—

(A.) The parts may gradually recover themselves, the exuded matters be absorbed, and the circulation be re-established. This is called "resolution."

*Phenomena of—
continued.*

Matters effused in.

(B.) If resolution does not take place, the essential part of the exudation either becomes organised or it degenerates, as in suppuration, ulceration, and mortification.

The fluid portions of the blood which contain a greater proportion of the salts (chloride of sodium and phosphates), and in the majority of instances, a larger amount of albumen and fibrine than in a state of health; and, according to present opinion, the white corpuscles of the blood, or "leucocytes." In addition, small quantities of the blood itself may be poured out, owing to the rupture of some of the minute vessels.

In inflammation of special tissues the natural secretions of these tissues may likewise be increased, as in the case of mucous or serous membranes.

Lymph.

This term is applied to the inflammatory exudation, which has the property of becoming converted into living tissue, or of becoming "organised."

Its Organisation.

It is by means of this organised material that wounds are healed,

*Its Organisation—
continued.*

granulations formed, tendons, bone, and other tissues repaired, and many other conditions (some of them advantageous, others injurious) brought about.

In order to become organised, lymph requires to be supplied with blood-vessels, and this is accomplished by the neighbouring vessels sending off processes or loops, which pass into the new tissue, and thus furnish it with nourishment. The tendency of lymph is to be converted into fibrous or fibro-cellular tissue; but it may undergo still further changes when effused in connection with certain special tissues. In connection with the organisation of lymph, it is interesting to note that a blood-clot may, under favourable circumstances, also become organised when it remains in contact with the living tissues.

Lymph, when not organised, either becomes absorbed, or disappears in the progress of suppuration or destruction of the tissues.

Serous Effusions.

The serous portions of the inflammatory effusion either pass out (if there is an exit for them), or become infiltrated

into the tissues, causing "œdema" or œdematous swelling. When the fluid collects in any of the cavities (as in the joints, peritoneal cavity, &c. &c.), it produces "dropsies" of these cavities.

Serum thus effused sometimes contains a considerable quantity of albumen, and in consequence may coagulate in the tissues or when shed. This coagulation is never followed by organisation as in the case of lymph.

Serous effusion may take place into the tissues or into cavities owing to simple congestion, or other causes than inflammation.

Condition of the Tissues in Inflammation.

The tissues of an inflamed part become more or less weakened or destroyed in the progress of inflammation, but the duration and amount of these changes vary very much according to the severity of the process and the condition of the patient or part affected. If the inflammation be slight, the tissues may be merely stimulated to a state of increased activity. In the neighbourhood of an inflamed part this is gener-

ally the case, so that new tissue or other products are more rapidly formed than they would be in the normal state.

Conclusions in regard to Inflammation.

(1.) When inflammation occurs in a healthy state of the system, and is mild in its nature, and limited in amount, the process may be considered a formative or reparative one, by means of the organisable exudation or lymph.

(2.) When inflammation occurs in an unhealthy state of the system, or is severe in its symptoms and unlimited in its progress, the process is a destructive one, by causing degeneration or death of the tissues.

(3.) When inflammation is slow in its progress (Chronic), the process leads to thickenings of the tissues, cedema, or dropsies.

(4.) When inflammation attacks special secreting surfaces, the natural secretions of these surfaces are usually increased in amount, more or less deteriorated in quality, and often mixed with some of the inflammatory effusions.

*Local.***Symptoms of Inflammation.**

- (1.) Pain.
- (2.) Heat.
- (3.) Redness.
- (4.) Swelling.
- (5.) Interference with function.

Pain.—This symptom varies in its nature and intensity. It may be sharp, throbbing, dull or aching, burning or itching. The nature and intensity of pain are influenced by the region or tissue affected, as well as by the severity of the inflammation, and the constitution or temperament of the individual. The pain may be felt at a part distant from the inflammation. This may be owing (1) To a continuity or connection of the nerves of the two parts; (2) To some functional relationship between them.

In inflammation of the parts connected with the special senses, these senses are more or less perverted.

Heat.—The temperature of an inflamed part is higher than in its healthy condition. This appears to be due to the chemical changes which take place in the tissues of the inflamed part.

Local—continued.

Redness.—This varies in its tints. It may be bright red, dark red, or almost purple, and it is usually most intense in the centre of the inflamed part. This symptom depends on the dilated state of the vessels, which also contain more blood than in health.

Swelling.—The amount of this varies much. In tissues of a lax nature, this symptom is usually well marked. At first it depends on the active congestion, afterwards on the fluids which are effused. The swelling is, in the first instance, compressible; but when effusion takes place, it is hard where the lymph has become organised; cedematous, where the serous effusion has occurred.

Interference with Function.—The function of an inflamed part may be completely stayed or destroyed, or it may be increased only; when the latter is the case, the functional results will be more or less impaired, according to the degree and amount of the inflammation.

Sympathetic Symptoms.

Pain and occasionally other of the

Local—continued.

local symptoms of inflammation are sometimes manifested at parts distant from the inflammation.

The symptoms of inflammation sometimes also suddenly leave one part and appear in another situation. This is termed "Metastasis."

These facts can only be explained by considering that there is some continuity of structure, some nervous or other connection, or some functional relationship between the parts.

Constitutional Symptoms.

These are termed "febrile" or Inflammatory fever. They are rigors, feeling of languor, quick pulse (usually above 100), high general temperature, great thirst, furred tongue, loss of appetite, headache, flushing of the face, heat and dryness of the skin, exhaustion, and, in severe cases, delirium.

The severity of the symptoms, both local and constitutional, and the rapidity of the progress of inflammation vary much in different cases. When the symptoms are well marked, and the progress rapid, the inflammation is said to be "*acute*," and when the symptoms

Local—continued.

are mild and the progress slow, the inflammation is termed "*chronic*."

Causes of Inflammation.**(1.) *Exciting.***

Mechanical injuries, chemical stimulants, and all causes which produce local irritation.

(2.) *Predisposing.*

A weak or unhealthy state of the constitution, temperament, and all causes, local or constitutional, which tend to interfere with the proper nutrition of the tissues.

Treatment of Inflammation stated very generally.**(1.) *Local.***

Remove any local cause of irritation, keep the part at rest, extract blood if the inflammation is very acute (by means of incisions, leeching, or cupping), apply heat (by means of poultices, fomentation, or other applications). The application of cold is serviceable in some instances, but it must be used carefully. Lotions or fomentations, containing preparations of opium or other sedative drugs, are also useful in relieving the pain of inflammation in certain cases.

In inflammation of deep or important

Local—continued.

textures, the employment of counter-irritation, at some convenient situation near the inflamed tissue, is often valuable.

(2.) Constitutional.

This consists in the administration of purgatives, diaphoretics, or sedatives, according as the symptoms seem to require them, strict attention to diet, a proper supply of fresh air, and the avoidance of anything likely to disturb the mind, or cause constitutional irritation.

If there is much weakness or exhaustion, it will be right to administer some form of stimulant or tonic together with proper nourishing food.

SUPPURATION, ABSCESS, SINUS, AND FISTULA.*Definition of.***Suppuration.**

The process by which the fluid "Pus" is formed. This process depends (according to the most recent opinions) upon an abnormal activity of the "pre-existing" cells of the tissue affected, and is accompanied with rapid multiplication of nuclei and formation of new cells, which, either in the substance of a tissue, or on a free surface, constitute the pus corpuscles.

Suppuration is, in the majority of instances, preceded by inflammation and its resulting exudation, which are proportionate in amount and effect to the severity of the action.

When pus has once formed, its tendency is to increase in amount, more or less rapidly, and to discharge itself by gradually working its way to a free surface. In doing this, it destroys, or causes to be absorbed, any intervening tissues. Under favour-

able circumstances the collection of pus becomes surrounded by a wall of lymph, and constitutes a "circumscribed" suppuration or "abscess." Under other circumstances, the suppuration, not being thus limited, spreads more or less quickly, destroying in its progress the tissues. Such a condition is termed "diffuse" suppuration. Pus is also formed in connection with granulating and other free surfaces (mucous, serous, &c. &c.) The pus from a granulating surface merely represents, as it were, an overplus of the granulation cells, which are thrown off without becoming organised.

Suppuration may, therefore, be divided into—

- (1.) Superficial.
- (2.) Interstitial.

The former is applied to suppuration when occurring on a free surface, the latter when it takes place in an unexposed tissue.

Causes of Suppuration.

Inflammation, or any local or constitutional source of irritation. The action of the atmosphere by reason

of the germs contained in it, would appear to be a cause of suppuration in connection with a wound or exposed surface.

Pus.

Its Composition.

A yellow or yellowish-white creamy fluid.

Consisting of { (1.) Serum.
(2.) Corpuscles.

The serum is the same as that of the blood, the corpuscles resemble the colourless corpuscles of the blood.

Pus may contain, in addition, more or less granular matter, portions of broken-down tissue, and blood corpuscles. In unhealthy conditions of the tissues or constitution, the pus cells are usually imperfect or degenerate.

Terms in connection with.

"*Laudable*," applied to pus which is normal in its appearance and properties.

"*Sanious*," when blood is mixed with the pus.

"*Ichorous*," thin and acrid pus.

"*Specific*," pus having specific properties.

"*Muco-purulent*," a mixture of pus and mucous.

Terms, &c., continued.

"*Sero-purulent*," a mixture of pus and serum.

"*Curdy*," when pus has a semi-solid or curded appearance, as occurs in scrofulous or unhealthy constitutions.

Absorption of.

Pus may be absorbed. The serous portion first disappears, and the corpuscles may then remain in the form of a dried-up paste or mass, or they may degenerate, break down, and disappear also.

Abscess.

Definition of.

A collection of pus, more or less perfectly limited by a wall of lymph. When the abscess has been rapid in its formation, and the suppuration active in its nature, it is termed an "acute" one. When it has been slower in its progress and mild in its symptoms, it is called a "chronic" one.

The inner surface of the lymph surrounding an abscess is in some instances a granulating one; in others, especially when the abscess is of long standing, it becomes smooth like a membrane. The term "Pyogenic membrane" has been applied to the lining membrane of an abscess.

Progress of.

An abscess when once formed and uninterfered with increases in size to a greater or less extent, and steadily works its way, more or less rapidly (by the destruction and absorption of the tissues), to a free surface (external or internal), where it projects, or, as it is termed, "points." Continuing its progress, it destroys or absorbs the skin or other structure covering the free surface at one or more points, and thus discharges its contents.

Symptoms of.

These vary somewhat according to the rapidity or slowness of the suppurative process and its situation. If the abscess is an "acute" one, the local symptoms of inflammation will have preceded its formation. There will be a swelling, which projects on some free surface, and becomes gradually more and more prominent. This swelling, too, will "fluctuate" when manipulated—that is, will have the feeling of containing a collection of fluid in it. In the progress of the abscess there will be pain and throbbing, varying in intensity in different cases. Suppuration in connection with bone and with fasciæ, or other fibrous

*Symptoms—
continued.*

membranes, usually causes much pain and throbbing. If the abscess is "chronic," the preceding symptoms of inflammation and the other signs will be slight, or they may not have been present at all. The swelling is slow in its progress, and does not "point" so readily as in the case of an acute abscess.

In addition to the local symptoms of an abscess, the constitution may be more or less affected. Rigors, and other signs of irritative fever, are often present.

General Treatment.

Remove, if possible, any cause which may be producing the suppuration. If the abscess is "acute," endeavour to check any inflammatory action by poulticing or other soothing means; and as soon as "fluctuation" can be detected, evacuate the pus by an incision, which should be made at the point most convenient for allowing all the fluid to escape from the cavity. The abscess should be opened and treated according to Mr. Lister's antiseptic method. This method, if properly carried out, undoubtedly prevents altogether, or very much diminishes, any further suppuration. Should the abscess be "chronic,"

*Treatment—
continued.*

and of some size, it should be opened by Mr. Lister's method, or emptied with an aspirator, or with a trochar and canula, for experience has shown that considerable constitutional irritation may result if such abscesses be opened by simple incision. After the pus has been evacuated from the cavity of an abscess, gentle pressure should be employed over it, so as to promote its contraction and healing; the part should be kept at rest, and any irritating causes, local or constitutional, avoided. Any general symptoms must be treated by proper means.

Diffuse Suppuration.

This kind of suppuration may be very rapid and destructive in its progress. Sometimes suppuration is diffuse owing to the nature of the tissue affected. In suppuration occurring in connection with the sheaths of tendons, periosteum, or other fibrous membranes, the pus, not being able readily to destroy these structures, and so discharge itself, runs along them, as it were, in order to find some way of escape, and it may thus become very diffuse.

Treatment.

Early and free incision, to allow the escape of the pus, and to prevent the destruction of tissue.

Proper constitutional treatment.

Definition of.

Sinus.

A passage or canal, the result of a partial contraction of the cavity of an abscess, or of any cavity produced by suppuration. The passage or canal continues to discharge pus, which is usually thin and ill-formed. It is at first lined with a granulating surface, more or less perfect, but after a time the inner surface of a sinus becomes smooth, and resembles in appearance a mucous or serous membrane.

Definition of.

Fistula.

A canal, the result of a still further contraction of a sinus or suppurating cavity. The term fistula is now generally confined to a canal the result of suppuration, which communicates unnaturally with secreting glands or their ducts (as salivary fistula), and to canals which communicate unnaturally with mucous canals or cavities (as fistula in ano). If a fistula exists for any length of time,

*Definition—
continued.*

its walls become thickened by a deposit of lymph, and its inner surface becomes smooth and membranous.

There is more or less discharge from a fistula, which varies in character and amount according to the cause producing it, and the tissue or organ with which it is connected.

*Terms in connection
with Fistula.*

Blind or Incomplete, when only one end opens on a free surface.

Complete, when both ends open on a free surface, one of which may be an external, and the other an internal one.

Causes of Sinus and Fistula.

(1.) Any prevention to the proper escape of pus from an abscess or other cavity.

(2.) The presence of a foreign body or of any dead or diseased bone or other tissue.

(3.) The escape of fluids or other matters owing to an unnatural communication with a secreting organ or its ducts, or with a mucous cavity or canal.

(4.) An unhealthy condition of the constitution.

**General Treatment of Sinus and
Fistula.**

If the retention of pus in a cavity is the cause, make an opening by incision (a "counter-opening"), which will allow its proper escape, or enlarge any existing opening if this will be sufficient. Sometimes the insertion of a drainage tube into the sinus will accomplish the object without any incision. If a foreign body, or portion of dead or diseased tissue, is the cause, remove it.

If fluids or other matters pass along the canal, owing to some obstruction of their natural channels, endeavour to remove the obstruction, and re-establish the natural passage. If the constitution is unhealthy, administer proper remedies.

If the cause has been removed, and the canal or cavity still remains unclosed, apply pressure over it. If the cause of its non-healing be a thickened or smooth condition of the lining membrane, stimulate or destroy this membrane by the application of caustics, stimulating lotions, or the actual cautery. If these fail, the canal or

cavity must be laid open by the knife. When a fistula is complete, it requires to be laid open along its full extent. In doing this, great care must be taken to include in the incision both its principal orifices or open ends.

MORTIFICATION.

Definition of.

Mortification.

Death of a portion of the body "en masse."

Terms in connection with.

Gangrene.

The process of a progressive death of a part.

Sphacelus.

Applied to the parts actually dead.

Sloughing.

Progressive death of the soft tissues.

Slough.

A limited portion of dead soft tissue.

Necrosis.

Death of bone.

Exfoliating.

The process of separation of a portion of dead bone from the living.

'An' Exfoliation.

A portion of dead bone separated.

Sequestrum.

A portion of dead bone enclosed in a new case of bone.

Terms, &c., continued.

Dry.

When dead parts are dry, owing to the slowness of the process and mildness of the preceding action.

Moist.

When dead parts are moist, owing to the greater rapidity of the process and severity of action.

Traumatic.

The result of injury.

Idiopathic.

The result of other causes.

Line of Demarcation.

The line which separates the dead from the living tissues.

Causes of Mortification.

- (1.) Inflammation.
- (2.) Mechanical injuries, the application of prolonged or of too great heat or cold; and the application of certain chemical agents.
- (3.) All obstructions to the arterial, venous, or capillary circulation.
- (4.) Interference with proper nervous supply or action.

Causes—continued.

(5.) An impoverished or poisoned state of the blood.

(6.) Introduction of poisonous matters into the tissues.

Inflammation is the principal cause of mortification ; for although a portion of the body may be immediately killed by injury or other means, the other causes just enumerated act, in the majority of instances, by weakening the tissues, and rendering them liable to be attacked with inflammation, which, in their weakened state, produces their complete destruction.

Symptoms of Mortification.*Local.*

(1.) Alteration in colour.

(2.) Loss of temperature.

(3.) Destruction of sensibility.

(4.) Vesication, separation of the cuticle, and putrefaction, if the soft textures are involved.

Constitutional.

Symptoms of Irritative Fever with delirium are usually present, unless the condition be very limited or slow in its progress.

General Treatment of Mortification.

Endeavour to subdue or remove any inflammatory action or other irritation

by soothing and antiseptic applications, such as a charcoal poultice. Protect parts which have been in any way weakened from all injury, over-excitement, or changes in temperature.

If gangrene is spreading rapidly, and is confined to the soft tissues, apply some strong caustic (nitric acid), in order to check its progress, promote the separation of the dead portion of tissue, and attend to the constitutional state and symptoms.

When the whole thickness and all the tissues of a limb or portion of it mortify, treat the part on the same principles, and operate according to the following rules.

Rules in regard to Operating.

Never operate until the *line of demarcation* has formed, except—

- (1.) The part has been immediately and completely killed.
- (2.) The amount of tissue which is dead, or which is likely to die, can be surely determined.
- (3.) When the gangrene is rapidly spreading.

ULCERATION AND ULCERS.

*Definition of.***Ulceration.**

Death of tissue on a free surface in imperceptible particles. The process takes place partly by degeneration, partly by solution, and partly by absorption; and is attended with more or less discharge, which varies in character and amount in different cases.

Causes of.

Ulceration may be slow in its progress, limited in extent, and confine itself to superficial textures; but in other cases it is very rapid in its action, destroys a large amount of tissue, or spreads to deep and important parts, so as to involve blood-vessels, or open into the cavities or canals.

Inflammation and all causes, local or constitutional, which tend to interfere with the healthy nutrition of the part or of the general system. In fact, the same causes which produce mortification may produce ulceration.

*Definition of.***Ulcer.**

A breach of surface the result of ulceration. Ulcers vary in their appearance, progress, and nature of discharge, according to the cause which produces or influences them.

Classification of Ulcers.

(1.) Those prevented from healing by defect of action.

(2.) Those prevented from healing by excess of action.

(3.) Those prevented from healing by peculiarity of action. (Syme.)

Ulcers may therefore be considered as granulating surfaces in a more or less unhealthy condition, and their essential treatment is to promote healthy action, and so produce a normal granulating surface.

1ST CLASS.*Symptoms of.***Weak Ulcer.**

Distinguished by the granulations being large, flabby, and pale in colour, the edges swollen and cedematous, and the discharge thin and watery. Any blood which may come from the surface is usually dark-coloured.

Treatment of.

Attention to health, remove, if possible, any local obstruction to the circulation, attend to the position of the part so as to favour its venous circulation, and apply some gentle stimulating dressing (zinc, boracic acid, or other lotion) to the surface of the ulcer.

*Symptoms of.***Indolent or Callous Ulcer.**

Distinguished by its hard, white, and raised edges, depressed surface, which is smooth, and of a greyish-white or dirty-brown colour. The discharge is thin and slimy, or muco-purulent, in appearance.

Treatment of.

Promote the absorption of the hard edges by pressure, which is best applied by means of strips of plaster or moistened lint passed over the whole extent of the ulcer, and then use water, or other simple dressing. If pressure does not succeed, a blister should be applied over the sore and its edges.

*Symptoms of.***Varicose Ulcer.**

Any ulcer situated on the lower extremity may be complicated with a more or less varicose condition of the veins; but the true varicose ulcer is usually small, and characterised by its

*Symptoms—
continued.*

painful symptoms and the well-marked varicose state of the veins in its neighbourhood.

Treatment.

Apply black wash to the sore, support the veins by means of a carefully-adjusted bandage, and favour the venous circulation by keeping the limb raised.

2ND CLASS.

Symptoms.

Inflamed or Irritable Ulcer.

All ulcers are liable to be irritated or inflamed by any local or constitutional disturbances. Such ulcers are termed irritable or inflamed, and are characterised by their edges and surface being ragged and irregular, and of a dark-red or brown colour. The discharge is thin, and often mixed with blood, and the ulcer is attended with more or less pain.

Treatment.

Remove any local or constitutional source of irritation, and apply poultices, a lotion of acetate of lead and opium, or other soothing means, to the sore and its margins.

Phagedænic Ulcer.

Distinguished by its rapid increase in size and destruction of tissue, owing to active ulceration.

Treatment.

If soothing applications fail to check the ulceration, dry the surface and edges of the sore, and apply freely to them nitric acid, or some other powerful caustic, and repeat the application if the ulceration still continues. The constitutional symptoms must be carefully attended to, and the strength supported.

Sloughing Ulcer.

Any ulcer may be attacked with sloughing or ulceration (*Phagedæna*), sometimes with both, and in consequence it rapidly increases by the destruction of tissue. When the former is present, the ulcer is said to be a "sloughing" one. When both exist, the ulcer is termed a "sloughing phagedænic" one. In these forms of ulcer the constitutional symptoms are often severe.

Treatment.

The same as in the phagedænic ulcer.

Mercurial and Syphilitic Ulcer.

3RD CLASS.

This ulcer may be the result of constitutional syphilis, or may be caused by the improper use of mercury, administered with a view to cure it.

Symptoms.

Such ulcers are usually numerous, rounded in shape, often undermine the

*Symptoms—
continued.*

skin, and frequently occur over a bone, which, together with its periosteum, may be affected. Some constitutional or other local symptoms of syphilis or mercurial poisoning are generally present, and will aid in the diagnosis.

Treatment.

Apply pressure or a blister over the ulcerated parts, so as to produce a healthy condition of the surrounding skin and tissue, and then dress the sores with black wash, or other simple lotion. Give Iodide of Potassium internally, and strengthen the constitution by means of good diet, tonics, and change of air.

Strumous or Scrofulous Ulcer.

These ulcers depend upon a scrofulous condition of the constitution. The ulceration may be confined to the skin, but it most frequently involves the subcutaneous tissue, so that the skin is often extensively undermined. The skin is thinned and discoloured, and presents numerous small openings or ulcers, which communicate with the affected tissue underneath. The granulations on the surface of these ulcers are weak, and show little signs of

Treatment.

activity, and the discharge is thin, and often mixed with curdy matter.

Treat the constitution by means of cod-liver oil and nourishing diet. Apply some simple dressing to the sores, and if they do not heal, use some slightly stimulating lotion. Should the skin be undermined, or the sores not heal with this treatment, chloride of zinc freely applied to the ulcerated surface will usually promote healthy action.

Cancerous Ulcer.

This form of ulcer is one of the symptoms which occur in the progress of cancerous disease. The characteristic symptom of these ulcers is, that they show no tendency to heal, but continue to spread, involve and destroy surrounding tissues, and implicate the glands and general system.

Symptoms.

Cancerous ulcers vary somewhat in appearance according to the particular form of cancer on which they depend. They generally have raised and everted edges, which are hard, nodular, or warty, the surface is irregular, with a tendency to bleed. The discharge is

*Symptoms—
continued.*

thin and bloody, frequently contains shreds of broken-down tissue, and often has a very offensive odour. The surrounding textures are usually more or less hard and nodulated. Old-standing ulcers, not originally cancerous, occasionally become attacked with the epithelial form of cancer, and so become true cancerous ulcers.

Treatment.

Complete destruction—by means of some strong caustic—of the entire ulcer, its edges, and any diseased tissues around it; or complete removal of the same by the knife.

In operating on such ulcers the rules which guide us in operating for cancer must be attended to.

Rodent Ulcer.

Symptoms.

This ulcer resembles somewhat in its appearance and tendencies the cancerous ulcer. It differs from a cancerous ulcer in having a smooth surface, in spreading more slowly, and in not implicating the lymphatic glands, or general system. It is generally situated on some portion of the face.

Treatment.

Entire removal of the disease by caustic or the knife.

HEALING OF WOUNDS.

Methods of Healing.

When a wound is made in the tissues, or a portion of tissue is separated or destroyed, the resulting wound, breach of surface, or cavity may heal in one of several ways. With one exception ("immediate union"), all these ways are effected through the agency of an exudation which becomes organised and converted into new tissue, which forms the "cicatrix" of the wound.

- (1.) Immediate union.
- (2.) Union by first intention.
- (3.) Scabbing.
- (4.) Granulation.
- (5.) Secondary adhesion.

Immediate Union.

Process of.

This is a rare form of healing, which takes place when the edges of a wound, or other divided tissue, are brought accurately together. In this union the surfaces adhere together, and their capil-

Process—continued.

laries become continuous, so that the circulation between the two surfaces is re-established. No cicatrix results from this union.

Union by First Intention.

This union is also termed "primary union," and occurs principally in connection with incised and clean wounds of the soft parts when their surfaces can be brought together, or nearly so, and when there is an absence of local and constitutional irritation.

Process of.

The exudation is the first phenomenon of this form of union, and then cells, which may be the result of an increased development of the cells of the surrounding tissues, or, according to other opinions, the "leucocytes" which have escaped from the blood-vessels, form in great numbers in and around the surfaces of the wound. The organisation and further development of these cells complete the healing of the wound without suppuration. This further development of the cells is a conversion of them into fibre cells and connective tissue, more or less perfect; or, more rarely, into other tissues re-

sembling that of which the wounded part is composed.

Scabbing.

Process of.

This form of healing is that which takes place when a scab or crust forms over the surface of a wound, or is produced artificially by the application of collodion or other means. It is not a very common kind of healing, and appears to take place by the development and organisation of new material, as in "primary" union without supuration, so that when the scab or crust loosens and falls off, the wound is healed or "skinned over."

Granulation.

Definition of.

The term Granulation, or union by "second intention," is applied to the process by which the exudation or lymph becomes organised on the surface of a wound or ulcer, in the form of small red points (granulations).

Process of.

Granulations are either formed by the proliferation of the tissue cells in the neighbourhood, or by the increase of the "leucocytes" which have escaped from the surrounding vessels. Some of these cells grouping together receive

Process—continued.

one or more loops from the neighbouring capillaries, so become organised, and form the small red prominences, or "granulations." Others of these cells, not becoming organised, are thrown off from the granulating surface as pus.

When a surface is covered by these granulations, it is called a "granulating" wound, sore, or surface; and if the granulations are small, bright-red, and the action of the surrounding parts is healthy, such a surface is called a "healthy granulating" one. Should the granulations not be of this nature, and the surrounding parts unhealthy in action, the surface, according to its condition, is classed under one of the varieties of "ulcer."

Secondary Adhesion.

This form of healing is also called "union by third intention," and is that which takes place when two granulating surfaces are brought together, and retained there.

Cicatrization.

This term is applied to the process by which the healing of a wound or

Process of.

surface by granulation or otherwise is completed.

Cicatrization is produced by the further organisation of the new material, by the contraction or drawing together of the surrounding parts, and by the formation of epithelial cells on the surface. The epithelial cells form first at the edge, or at any other part where there is whole skin, and gradually extend over the surface until it is "skinned over." The resulting mark or texture is called a "cicatrix," the structure of which is principally composed of fibrous or connective tissue more or less perfect. The structure forming a cicatrix remains for some time elastic. It has also a great tendency to contract, and hence the contraction and deformity produced in connection with the healing of large wounds if means are not used to counteract this tendency.

Principles of Treatment.

It is impossible here to give in detail the various methods of treating wounds, but there are certain general

principles, applicable in all cases, which may be referred to.

(1.) Rest of the part as complete as possible.

(2.) The avoidance of, or removal by suitable means, if present, of all local and general irritation, or of anything likely to produce them.

(3.) The staying of all hæmorrhage by proper means.

(4.) The provision, by drainage tubes or otherwise, for the free escape of all fluids which may collect between the surfaces of the wound or in its cavity.

(5.) Keeping the patient in an atmosphere as healthy as possible, and strict attention to other hygienic rules.

(6.) The accurate adaptation of the surfaces and edges of the wound, when possible, by means of sutures, position of the part, plaster, or other recognised methods.

(7.) The application of suitable dressing or treatment to the wound itself. In all applications to the wound itself, the importance of antiseptic principles must be considered and, when possible, some form of antiseptic dressing should

be used. The very valuable researches of Mr. Lister, and the practical experience of himself and his followers, of which I am one, have abundantly proved the success of his *special* anti-septic treatment; and, therefore, I have no hesitation in advocating its adoption when circumstances will allow it to be used properly, and with attention to all its details.

ABSTRACTS
OF
SURGICAL PRINCIPLES.

BY
THOMAS ANNANDALE, F.R.S. & F.R.C.S. (Ed.)



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PART II.
TUMOURS, OR MORBID GROWTHS.

SECOND EDITION.

EDINBURGH :
MACLACHLAN & STEWART, 64 SOUTH BRIDGE,
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P R E F A C E.

THESE Papers were originally printed solely for the use of gentlemen attending my Class of Systematic Surgery ; but having been frequently requested to make them more public, I am induced to place them within the reach of the Medical Students of Edinburgh, with the sincere wish that they may be found an assistance in the study of some of the important principles of Surgery.

My object in preparing these Papers has been to give a concise abstract of the subjects treated of in a form intelligible to the youngest student.

It has certainly not been my intention that these Abstracts should take the place of more extended works on Surgery ; but it is my hope that a study of them will promote a better understanding of such works and their contents.

THOMAS ANNANDALE.

ABSTRACTS OF SURGICAL PRINCIPLES.

TUMOURS, OR MORBID GROWTHS.

Definition of.

A "TUMOUR" is a living and independent growth or structure, which may originate in, or form in connection with, any of the tissues of the body. Such a growth is an unnatural or diseased development of tissue, and hence is termed "morbid."

A tumour differs from a simple *Hypertrophy*—(1st) In composition and shape. The structures composing a tumour, whether or not they resemble natural tissues, have usually some peculiarity either in form or arrangement which is sufficient to distinguish them from a portion of ordinary tissue. A tumour in its growth assumes no regular shape, nor does it take the form of a natural tissue or organ.

A Hypertrophy is a simple increase

*Definition of—
continued.*

in size and development of the natural tissues, and the affected structure or organ, although enlarged, retains its original arrangement and form.

(2nd) In function. A tumour, although it lives, grows, and may undergo certain changes, is not capable of performing any useful function.

A tissue or organ which is hypertrophied may, and does in many cases, perform its peculiar functions perfectly.

*General Pathology
and Structure of.*

Tumours vary much in their structure. Some of them are entirely *local* in their nature and origin, while others, again, are merely *local manifestations* of a constitutional disease or cachexia.

The structure of some tumours exactly resembles certain of the natural tissues of the body (as the fatty, osseous, &c.) In other tumours the structure, although resembling natural tissues, is more or less modified in composition and arrangement. In other tumours, again, the structure resembles no natural tissue (as in the majority of cancers).

Nourishment of.

Tumours are nourished by means

*Nourishment of—
continued.*

of special arteries which enter, and veins which pass out of, their substance.

The number, size, and arrangement of the blood-vessels vary in different tumours. In some, the distribution of the vessels is the same as in natural tissue; in others it is quite peculiar; again, in a certain class of tumours (the vascular) the vessels themselves form the principal bulk of the growth.

Tumours have not as yet been found to receive any direct nervous supply, although nerves are frequently found running through, or stretched over them.

Growth and Shape.

Some tumours are limited in their growth, others continue to grow until they attain a large size. Tumours vary in their shape. *Simple* tumours are usually circumscribed, surrounded by a capsule composed of areolar tissue, and assume a rounded, oval, or lobulated shape, which, however, may be modified by the pressure of surrounding textures.

The *malignant* tumours are generally met with as infiltrations or irregular

*Growth and Shape—
continued.*

masses. Occasionally they occur as circumscribed growths, when they may attain a large size.

The pressure of any simple tumour may cause a gradual absorption or expansion of soft or osseous tissue. The pressure of a malignant tumour may lead to the same result, but the latter growth is more apt to destroy the tissues by actual implication of them.

Alterations in.

Tumours, like other tissues, may become inflamed, ulcerate, or mortify. The result of any of these conditions may be a partial or complete destruction of the growth. When tumours ulcerate, the ulceration usually involves the surrounding tissues, spreading more or less rapidly, according to the nature of the growth. Tumours occasionally, also, undergo an *atrophy*, or disappear entirely.

Tumours, again, are liable to *degeneration*, in part or in whole their structure becoming changed into fatty, calcareous, or pigmentary matter. Hence the terms *Fatty*, *Calcareous*, and *Pigmentary* degeneration. In addition to the changes mentioned, tumours originally of a simple nature may,

*Alterations in—
continued.*

Diagnosis of.

without actually becoming cancerous, acquire some of the characteristics of malignant tumours.

Although, no doubt, much experience is necessary in order to ascertain, surely and with ease, the nature of any tumour, the student may, by careful inquiry and examination, acquire in time the power of sound and accurate diagnosis in regard to this subject. In order, then, to acquire this power, the student should inquire into the history of the patient, and more especially into the origin and progress of the growth. He should particularly inquire as to the *situation*, *amount of mobility*, *consistence*, *shape*, and *size* of the growth when first discovered, and its *progress* since; and should find out if any treatment has been employed, and if so, with what effect. Having determined these points, he ought then to proceed to make a careful examination of the tumour itself, and note—

1st, Its consistence. It is sometimes a difficult matter to distinguish between the feel of a solid tumour and that produced by the presence of fluid

*Diagnosis of—
continued.*

confined in a tense cyst. In doubtful cases, a fine trochar or grooved needle may be inserted into the substance of the tumour, so as to determine this point.

2nd, Its amount of mobility, and its connection with the surrounding tissues. If the tumour is fixed or adherent at one or more points, the student should try to determine the exact structures, superficial or deep, to which it is attached or which fix it; for this point is of importance in connection with the question of the removal of the growth.

3rd, Any symptoms which the tumour may be giving rise to. Certain tumours (neuromas and subcutaneous tumours) give rise to pain, which is a special and constant symptom of such growths; but the symptom of pain in connection with other tumours cannot be said to be of much importance as a means of diagnosis, for it does not occur with any regularity, and principally depends on whether or not nerves or their branches are pressed upon or involved.

General Treatment.

The great principle of the treatment

General Treatment—
continued.

of morbid growths may be said to be —*To take away or destroy the entire tumour, provided this can be done without injury to important structures, such as would endanger life.* A tumour may thus be removed by the *knife*, by the *ligature*, by *caustic*, or by the *galvanic cautery*, or *ecraseur*. The first of these is, in the majority of instances, the best. In employing the knife, the nature of the tumour must be considered. If the growth is a *simple* one, it will only be necessary to remove the growth itself, more or less dissection being required according to its connections with surrounding parts. Should, however, the tumour be a *malignant* one, or one with malignant tendencies, not only it, but a free margin of surrounding healthy tissue, must be taken away. If the disease has originated in the substance of a bone or gland, the portion of bone involved or the entire bone or gland is to be removed along with the growth.

The ligature made of silk, elastic cord, or prepared catgut is principally used in certain cases of vascular tumour. When used it should be applied as

*General Treatment—
continued.*

firmly as possible, so as thoroughly to strangulate the whole substance of the growth.

When caustic is employed, it ought to be a powerful one (strong sulphuric acid, chloride of zinc, or caustic potash), and it should be applied so that it will act upon the whole growth.

The galvanic cautery and ecraseur are employed to take away tumours in connection with the tongue and genital organs, or from other parts where the use of the knife is less safe or convenient.

Some tumours, as certain kinds of cysts and vascular growths, may be destroyed by exciting inflammation in them, the result being—in the one tumour, obliteration of the cyst; and in the other, coagulation in and obliteration of the blood-vessels, which form the principal bulk of a vascular tumour.

*Classification of
Tumours.*

All classifications of tumours are more or less imperfect; but the most convenient one for practical purposes is that suggested by Paget, who divides morbid growths into two principal classes—viz., *Simple* and *Malignant*.

Varieties of.

Simple or Innocent Tumours.

- (1.) Fatty.
- (2.) Fibrous, Fibro-cellular, and Sarcoma.
- (3.) Cystic.
- (4.) Glandular.
- (5.) Cartilaginous and Myeloid.
- (6.) Osseous.
- (7.) Vascular.

Characteristics of.

- (A.) Their structure resembles some of the natural tissues of the body in a more or less complete state of development.
- (B.) They are distinctly circumscribed, are surrounded by a capsule more or less complete, and do not infiltrate surrounding tissues, although sometimes continuous with them.
- (C.) When they ulcerate, the ulceration is simple in its nature.
- (D.) They do not recur when entirely removed, or affect the lymphatic system.

*Characteristics of—
continued.*

(E.) They do not interfere with the health of the patient, unless under peculiar circumstances.

These are the principal characteristics of a *simple* or *innocent* tumour, but tumours of this class are met with in which some of these characteristics are perverted, such growths assuming certain of the peculiarities of the *malignant* type. Thus fibrous, or fibro-cellular, and cartilaginous tumours will, in some instances, recur (not once, but many times) when removed, grow rapidly, ulcerate, and even in rare instances affect the lymphatic system.

Varieties of.

Malignant Tumours or Cancers.

- (1.) Scirrhus cancer.
- (2.) Medullary cancer.
- (3.) Epithelial cancer.
- (4.) Colloid cancer.
- (5.) Melanotic cancer.
- (6.) Osteoid cancer.

Characteristics of.

(A.) They are composed of structures which do not naturally exist in the body, and which are peculiarly arranged.

*Characteristics of—
continued.*

- (B.) They are not circumscribed, but their structure infiltrates surrounding tissues. In some forms of cancer the tumour may at first be limited and have a temporary capsule, but sooner or later the neighbouring parts become involved.
- (C.) When they ulcerate, the ulceration continues to spread, and destroy tissue, and shows no tendency to heal.
- (D.) When removed, they recur sooner or later in or near the cicatrix, in the lymphatic system, or in some of the internal organs.
- (E.) The health of the patient, sooner or later in the progress of the disease, becomes affected, constituting what is termed the "Cancerous cachexia."

The *intensity* of these characteristics varies in the different varieties of the *malignant* class of tumours, and also in different cases of the same variety.

Special Tumours.*Simple Tumours.***Fatty.**

These tumours are most frequently met with as circumscribed growths, more rarely they occur as a prolongation or continuation of the natural fatty tissue of a part. Hence fatty tumours are divided into *circumscribed* and *continuous*. The latter are sometimes congenital.

Structure.

Lobules of fat, with more or less delicate fibro-cellular connective tissue interspersed, separating the lobules when they exist, and forming a capsule or covering for the whole tumour. The amount and development of the connective tissue varies somewhat in different tumours. Fatty tumours vary in size; they are usually of slow growth, and if not interfered with, may attain a weight of many pounds. Their shape is rounded, generally somewhat flattened, and in the majority of instances they are distinctly lobulated. (It must, however, be remembered that the shape of any tumour may be considerably modified by pressure.) They are some-

*Structure—
continued.*

times pedunculated, and have a neck varying in length and thickness in different cases. Fatty growths usually occur *singly*, but occasionally they are *multiple*.

Situations of.

Most common in subcutaneous tissue, more rarely between or under muscles. Occasionally they are met with in connection with the inguinal canal or other hernial regions, and are apt to simulate a hernia. It will sometimes happen that a fatty tumour gradually leaves its original position. Thus, a fatty tumour growing in the groin may in time pass down into the perinæum.

Diagnosis of.

A circumscribed movable growth (if external pressure has been in any way applied over the tumour for some time, or if inflammation has attacked it, the growth may be adherent at one or other of its surfaces to the surrounding tissues)—generally distinctly lobulated, soft, and elastic to the touch, with a history of slow growth. Such a tumour, too, is, in the majority of instances, situated under the skin, in the subcutaneous tissue.

*Alterations in
Structure.*

Inflammation, suppuration, or even sloughing, may attack the substance of

Alterations in Structure—continued.

a fatty growth ; but this is rare. Portions of these growths are sometimes (rarely) converted into calcareous or osseous masses ; and, occasionally, cysts have been met with in their substance.

Treatment.

Removal by the knife—taking care to dissect or draw out all the lobules or processes. These tumours are, in most cases, only loosely connected to surrounding parts, so that if a free incision be made through the textures covering them, and through their capsule, they can be readily separated and removed. If, however, any part of the growth is adherent, a little dissection with the knife may be required.

Fibrous Tumours.

Structure of.

The true *fibrous* tumours are composed of well-developed fibrous tissue, the fibres of which may be arranged—

(A) In concentric circles or layers.
(B) In bundles, interlacing, more or less, one another. (C) Closely packed together, so as to resemble a smooth and continuous tissue. The section of a fibrous growth varies according to the arrangement of its fibres. It is usually white or yellowish in tint, in some

Structure of:--
continued.

cases glistening, and of a bluish colour. In some tumours, the surface is smooth and continuous; in others, the bundles of fibres and their arrangements can be seen distinctly. All these growths are surrounded by a distinct capsule. They are usually firm to the touch, circumscribed, of comparatively slow growth, and may grow to a large size, especially when they occur in the uterus or in the jaws. Their shape is rounded or oval, sometimes lobulated; but their form may be much altered by the pressure of surrounding tissues. Occasionally they are met with *pedunculated*, and constitute one kind of polypus met within the uterus, nasal passages, pharynx, rectum, or other mucous canal. Fibrous tumours are usually *single*, except when in the uterus, or in connection with nerves. In these situations they often occur *multiple*.

Situations of.

Most common in the uterus, in connection with bones (especially the jaws) and periosteum, nerves, sheaths of tendons, and subcutaneous tissue.

Diagnosis of. •

A circumscribed tumour occurring in one of the regions or tissues referred

*Diagnosis of—
continued.*

to, firm to the touch, and having a rounded, oval, or lobulated shape. The hardness of a fibrous tumour may be more or less modified, according to its composition and situation. If the tumour, or a portion of it, has undergone calcification or ossification, it may feel like bone. Again, if the tumour has originated in the periosteum or bone, it may be bound down by the periosteum, or may be enclosed within the bone. In either case, the tumour may be very hard to the touch.

Fibro-cellular Tumours.

Structure of.

The *fibro-cellular* tumours are composed of tissue, resembling the areolar form of connective tissue. In some of these growths, the fibres are very fine and filamentous, while in others they are coarser. The arrangement and development of the fibres also differ in different tumours. The cells, in these growths, vary in amount, and may be rounded, elongated, or even stellate; they usually contain nuclei. Occasionally the nuclei are free and numerous. In most fibro-cellular tumours there is a considerable quantity of serous fluid

Structure of—
continued.

infiltrated into their substance, which oozes out if the growth be incised or punctured.

These tumours vary somewhat in feel, according to their structure and its arrangement. They are usually rounded, oval, or lobulated in shape, and have an investing capsule. Fibro-cellular tumours are not always circumscribed, but occur also as out-growths. In such cases, the tumour is merely a hypertrophy of the natural cutaneous structure, and has, therefore, no distinct limitation.

Situations of.

These growths are almost always found in connection with the skin or mucous membrane. Occasionally, however, they originate in the intermuscular spaces. They are common in the scrotum, prepuce, labia, and clitoris, more rarely in other regions. Sometimes they occur in these situations as circumscribed tumours, but more frequently as an enlargement or a hypertrophy of the natural parts. A special variety of the fibro-cellular tumour is the *painful subcutaneous tumour*, which is met with as a small oval or rounded growth of firm consistence,

*Situations of—
continued.*

often adherent to the skin, and characterised by causing peculiar painful symptoms, which are entirely removed by the excision of the growth. These tumours differ from a neuroma in the fact that they do not possess a visible connection with any nervous branch. The common mucous polypus, met with in the nose and other situations, is an example of a fibro-cellular tumour growing in connection with the mucous membrane. This growth is composed of delicate fibro-cellular tissue, covered by mucous membrane, and has usually more or less serous fluid infiltrated into its substance.

Warts of a *simple* nature must also be classed among the fibro-cellular tumours, for they are merely growths from the skin, and composed of the same structures, which, however, are generally exaggerated in their development.

Diagnosis of.

The majority of *solid* tumours of a *simple* nature, which grow in connection with the skin or mucous membrane, are fibro-cellular in their structure, although they may present considerable differences in their ex-

*Diagnosis of—
continued.*

ternal appearance, symptoms, and progress.

As closely allied to the fibro-cellular tumours, we specially notice the *recurrent-fibroid* tumours, or “spindle-celled sarcoma.”

Structure of.

The structure of these tumours is principally cellular, and consequently they approach in character the class of malignant growths. They do not, however, affect the lymphatic or general system, but are characterised by their more rapid growth, and their strong tendency to recur when removed, either in the cicatrix or neighbouring tissues. The cells composing these tumours are elongated, oval, or caudate in shape, and their arrangement is generally irregular, the nuclei are usually numerous and well-marked.

Fibroid tumours are, like other fibrous growths, rounded, oval, or lobulated in shape. Their consistence is softer and more elastic than a well-marked fibrous tumour; but it is not always easy to distinguish them at the commencement of their growth. Their progress is, however, more rapid, and they have a greater tendency to ulcerate

*Structure of—
continued.*

and fungate. The section of these growths is glistening, and of a greyish colour, with more or less of a pink tint.

Situations of.

These tumours are most frequently met with in connection with the skin and subcutaneous tissue and intermuscular spaces.

Diagnosis of.

As these tumours in the first instance resemble the fibrous growths, it is not always easy to distinguish them by external examination. The fibroid tumour is, however, of more rapid growth, and usually softer to the feel. If the tumour has been previously removed and recurs, its true nature will be determined.

*Alterations in
Structure.*

Fibrous tumours, especially those in the uterus, may undergo calcareous degeneration, and, in consequence, may have more or less of their substance converted into calcareous matter. Fibrous tumours, which grow in connection with periosteum or bone, and occasionally those forming in other tissues, may also undergo ossification—that is, have portions of their substance formed into bone. This usually takes place in the form of spiculæ or scales. Cysts,

Alterations in Structure—continued.

varying in size and number, are not unfrequently met with in the substance of fibrous tumours. Such tumours are sometimes termed *fibro-cystic*.

Treatment of Fibrous and Fibro-cellular Tumours.

The simple *fibrous* and *fibro-cellular* growths must be removed by the knife, the tumour alone being dissected out. When a fibrous tumour grows in connection with bone, and cannot be enucleated entire by incising its coverings and capsule, the growth can only be satisfactorily taken away by removing along with it the entire portion of bone with which it is connected. If a fibro-cellular tumour is an out-growth or hypertrophy, and is from its bulk or position causing inconvenience, and has resisted the ordinary treatment of hypertrophy, as much of its substance as can be taken away with safety should be removed. It is on this principle that the large tumours of the scrotum are treated by operation.

A *recurrent-fibroid* tumour, when diagnosed by its history or symptoms, must be treated on the same principles as a malignant tumour—namely, by a free removal of the tumour, and a margin of healthy surrounding tissue,

*Treatment of—
continued.*

with the knife, or corresponding destruction with some strong caustic.

Sarcoma.

In connection with the fibro-cellular tumours, attention must be directed to the class of tumours now termed "Sarcoma" by some authors.

Structure of.

A sarcoma may be described as a tumour, the structure of which consists of cells resembling those met with in some of the tissues (connective tissue, bone, cartilage, muscles, or nerves), or in the embryo, and of an intercellular substance, which varies in different tumours according to the situation of the growth. The largest part of the structure of these tumours is cellular, and although many of them are the same as the fibro-cellular or other simple tumours, described under different terms, in their composition, and are "innocent" in their tendencies, others of them more resemble the cancers in their behaviour.

Varieties of.

The principal varieties of "sarcoma," as described by Continental authors, are —(1.) *Spindle-celled sarcoma*, or tumours composed principally of elon-

*Varieties of—
continued.*

gated-shaped cells, such as are met with in the "recurrent - fibroid" growths. (2.) *Rounded-celled sarcoma*, or *Lympho-sarcoma*, or tumours composed principally of round-shaped cells. When occurring in connection with nerve structures, as in the eye, they are termed *Glioma*. (3.) *Giant-celled sarcoma*, in which the characteristic structure consists of large cells with many nuclei, such as occur in the foetal marrow. The *myeloid* tumour is an example of this growth. (4.) *Mucous sarcoma*, or *Myxoma*, in which there is mucus or mucin in the intercellular substance of the growth. The cells of this kind of tumour are most frequently large and stellate, the processes or projections of the cells communicating with one another, and forming a kind of open network. The term *Sarcoma* may also be used in connection with other varieties of tumour, as "adenosarcoma," or "glandular" tumour, and "osteo-sarcoma," or "osseous" tumour of a simple nature.

*Diagnosis and
Treatment.*

In the present state of our knowledge, it is impossible to define the exact diagnostic symptoms and the

Diagnosis, &c.—
continued.

treatment of all these varieties of sarcoma, the true nature of which is only determined in many instances by microscopic examination. Their diagnosis will be assisted by a consideration—(1) Of the tissue or organ in connection with which they originate; (2) Of their progress and action on surrounding parts, and on the lymphatic and general system.

Their treatment must depend upon their characteristics. If simple or innocent in their tendencies, they will require to be treated according to the principles already referred to; but if they show malignant or cancerous tendencies, they must be treated as if they were true cancers.

Cystic Tumours.

These growths may be divided into—(1) Simple Cysts; (2) Compound or Proliferous Cysts.

Structure of.

According to Paget, cysts may be formed—(A) By the enlargement and fusion of the spaces or areolæ in connective or other tissue; (B) By the dilatation and growth of natural ducts or sacculi; (C) By the growth of

*Structure of—
continued.*

new-formed elementary structures having the characters of cells or nuclei.

Cystic tumours vary much in the thickness of their walls, and also in the nature of their contents. The walls of some cysts are more or less continuous with or adherent to surrounding tissues, while other cysts are very loosely connected to surrounding parts, and can be readily separated from them, as in the case of the common *wen*, so frequently met with on the scalp. The internal surface of the cyst wall is generally smooth, and in many instances has the power of secreting the fluids or other matters which occupy its cavity.

The contents of cysts vary in consistence and colour; they may be fluid, semi-solid, or solid.

Cysts frequently, also, form in connection with, or in the substance of, solid growths, simple or malignant.

Simple Cysts.

(1.) *Simple Cysts.*—These tumours are met with (1) as Single cysts, (2) as Multiple cysts.

The contents of simple cysts are very various, as regards consistence, composition, and colour. These con-

*Simple Cysts—
continued.*

tents may be (1)—Serous fluid clear, straw-coloured, or bloody, or of a green, brown, or yellow hue (the latter often owing to the presence of golden scales of cholesterine). (2) Viscid fluid resembling synovial fluid or mucous. (3) Natural secretions of a gland, in connection with which the cyst or cysts have formed. (Milk, or semen, for example.)

Simple cysts, whether single or multiple, may grow to a large size if not interfered with, and in their progress may cause absorption or expansion of the surrounding tissues, soft or osseous. They sometimes occur as congenital growths.

Situations of.

Most common in connection with certain of the glands (as the breast and thyroid glands), with the skin, mucous and serous membranes, with bones, and intermuscular spaces (superficial and deep). In all these situations the cysts may be single or multiple.

Proliferous Cysts.

(2.) *Proliferous Cysts.*—These are cysts which have in their interior other cysts, or solid organised growths or structures.

Structure of.

The cysts contained in a proliferous cyst may be broad-based and rounded, or slender and pedunculated, and, occasionally, they are of other shapes. These growths are common in the ovaries and in the chorion.

The growths in the interior of a proliferous cyst may be large, rounded, and more or less pendulous, small and pedunculated, or flat, resembling granulations; they may partially or completely fill the cavity of the cyst. In the latter case, the cyst may simulate a solid tumour.

The structure of the intracystic growths is most frequently glandular, and resembles that of the particular gland in connection with which the cyst has formed. Such "proliferous glandular" cysts are most common in the breast, thyroid gland, prostate gland, and lips.

In some instances the growths have no distinct glandular structure, but are composed of imperfectly-developed fibrous or connective tissue.

Cysts containing, in their interior structures, hairs and fatty matter, which are formed in connection with

*Structure of—
continued.*

skin, are met with in the ovaries, subcutaneous tissue, and, very rarely, in a few other situations, as in the testicle, and kidney, under the tongue, and within the skull. These cysts have been termed "cutaneous proliferous cysts." Paget considers that the common sebaceous cyst met with in the scalp and other situations is an "imperfect imitation" of the cutaneous proliferous cyst. Lastly, proliferous cysts may contain growths of a cancerous nature.

*Diagnosis of Cystic
Tumours.*

Cysts vary so much in their number, in the thickness of their walls, and in the consistence and amount of their contents, that it is difficult to lay down any very general rules in regard to their diagnosis. In the majority of cystic tumours having fluid contents, the feeling of fluctuation can be detected; but even this feeling is not always distinct, and may be masked by the extreme tension of the cyst, or by its being confined or compressed by surrounding tissues. If fluctuation exists, the student should endeavour to ascertain (1) the nature of the fluid, and if it is contained in one or more cysts, and (2) if the fluid contained in

*Diagnosis of Cystic
Tumours—cont.*

the cavity of the cyst or cysts makes up the whole bulk of the tumour, or if there is also some solid growth connected with it. These two points are of importance in connection with the treatment. When there is any difficulty as to the diagnosis of a tumour, supposed to be cystic, a fine trochar and canula, the needle of an aspirator, or an exploring needle, should be passed into the cyst. This will decide the points just referred to.

*Alteration in
Structure.*

Cysts are sometimes attacked with inflammation and suppuration, which either lead to obliteration of their cavity, or cause a troublesome ulcer or sinus, which continues to discharge as long as any of the cyst wall remains. The walls of cystic tumours, or portions of them, are occasionally converted into calcareous or osseous structure.

*Treatment of Cystic
Tumours.*

If the cyst is *simple* and *single*, and its contents are fluid or semi-solid, it will, in the majority of instances, be cured by causing obliteration of its cavity. This condition is best brought about by first emptying the cyst, either by tapping or incision, and then apply-

*Treatment of Cystic
Tumours—cont.*

ing a fly-blister or pressure over it, injecting it with iodine, introducing a thread or drainage-tube, so as to cause suppuration of its cavity, or cutting out a portion of the cyst wall with the same object. Should the cyst be opened by incision, the employment of antiseptic treatment is most valuable. In choosing which of these methods should be adopted, the practitioner must be guided by the nature and situation of the growth, and by the practice which has proved most successful. In the cysts the lining membrane of which has the property of secreting fluid, it is often very difficult to obtain a closure of their cavity; and this can only be accomplished by laying the cyst freely open, and endeavouring to obtain a complete obliteration of the entire cavity. If a cyst resists this treatment, and admits of safe removal, it may be dissected out.

Cysts which are *simple* and *multiple* may, if not very numerous, be treated on the same principle as the single cysts; but if they are very numerous, or associated with any solid growth, the entire mass of the tumour must be

*Treatment of Cystic
Tumours—cont.*

cut out. When multiple cysts are situated in a gland, such as the breast, the *entire gland* should be removed.

Multiple cysts in the breast may be grouped together, or may be scattered, as it were, through the gland. In either case it is better to remove the whole breast. When a cystic tumour affects a bone, the whole portion of bone implicated in the growth must be removed, along with the tumour.

Compound or proliferous cysts can only be surely removed by dissecting out the whole growth, or by removing the gland or structure in which they have formed.

Glandular or "Adenoid" Tumours.

Structure of.

These growths are composed of structures resembling the gland in which, or near which, they originate. The gland structure is more or less perfectly developed in different instances, and the rapidity of its development also varies. In the majority of cases, a glandular tumour is of slow growth, is firm to the touch, circumscribed, and lobulated. Such growths may attain a large size ; they may occur single or

*Structure of—
continued.*

multiple. The section of these tumours is white, or yellowish-white, and glistening. Not unfrequently the section shows, here and there, yellow points (fatty degeneration); and in those tumours occurring in connection with the parotid gland, cartilaginous structure is very often seen.

*Alteration in
Structure.*

Glandular tumours sometimes undergo fatty degeneration. Portions of their structure may become converted into cartilaginous tissue; and lastly, such growths occasionally undergo absorption, and disappear altogether.

Situation of.

Most common in or near the breast, parotid, prostate, and thyroid glands, and in connection with the small glands of the labia and lips.

Diagnosis of.

A circumscribed and lobulated tumour, of firm consistence, situated in the substance, or in the neighbourhood, of one of the glands mentioned.

Treatment of.

Removal of the tumour or tumours by the knife. When the capsule has been divided, the growth is usually readily separated from surrounding textures. Not unfrequently, however, it is adherent at one aspect (the under one generally) to the gland, with which

*Treatment of—
continued.*

it is connected. Care must be taken to separate all the lobules or processes which sometimes dip into the neighbouring tissues.

Structure of.

Cartilaginous Tumours.

The term "Enchondroma" is also applied to these tumours.

They are most frequently found growing in connection with bone or periosteum, rarely in other situations. When growing in the bones they may occur as circumscribed masses, or as infiltrations which affect both the compact and the cancellated texture.

The consistence of cartilaginous tumours varies in different instances. In some growths it is not thicker than jelly, in others it is much firmer; and in growths which have undergone ossification, it may be as hard as bone.

The microscopic structure consists—

(1.) Of a basis or intercellular substance which varies in different growths. It may be thin and more or less transparent; or it may be denser, resembling fibrous tissue; or, again, it may be distinctly fibrous in character.

(2.) Of cells which vary in appear-

*Structure of—
continued.*

ance and arrangement in different cases. In some tumours the cells are large and nucleated, and surrounded by intercellular substance; in others, the cells are smaller and grouped together.

(3.) Of nuclei, which also vary in shape. One kind of nucleus of an irregular shape, and having branches or processes, is met with in cartilaginous tumours, and is apparently peculiar to such growths.

Cartilaginous tumours are usually of slow growth, but cases are sometimes met with in which their growth is more rapid. They may attain a very large size (I have seen one which weighed fifty-two pounds), and they may occur as single growths, or may be multiple. Occasionally many bones, or almost all the bones in the body, are affected with these tumours. When the tumour affects a bone, it may originate in the exterior, or may spring from the outer table. In the majority of instances, both the outer and inner portions of the bone are involved to a greater or less extent.

Situation of.

Very common in connection with the bones of the hand, the articular

*Situation of—
continued.*

extremities of the long bones, the ribs, sternum, bones of the pelvis, and other bones, with the exception of those of the head and face, which they rarely affect. Very rarely in the testicle, breast, and subcutaneous tissue.

Diagnosis of.

A tumour of firm consistence, not usually elastic to the touch, and almost always growing in intimate connection with, and consequently firmly attached to, a bone. The growth of such a tumour is usually slow, although it must be remembered that exceptional cases are occasionally met with.

*Alteration in
Structure.*

Cartilaginous tumours have a great tendency to become converted into osseous structure, so that very frequently more or less of their substance undergoes ossification. These growths are occasionally attacked with inflammation and ulceration, which may lead to destruction of portions of their structure, and more rarely to a fungous protrusion of their substance. Cysts are also sometimes developed in these growths.

Treatment of.

When these tumours grow in connection with bone, it is necessary, in the majority of instances, to remove,

*Treatment of—
continued.*

along with the tumour (either by amputation or excision), the portion of bone, or the entire bone or bones, from which they spring. Unless this is done, there can be no certainty that the whole disease is taken away. If the tumour should be situated in an organ or region, it may, if quite circumscribed, be dissected out, or, if not circumscribed, and more convenient, the entire organ, or a free portion of the surrounding tissue, should be taken away along with the growths.

Myeloid tumours resemble very much, in their tendencies, situations, and growth, cartilaginous tumours. They possess, however, one peculiarity, namely, the existence in their structure of certain nucleated cells similar to what are found in the foetal marrow. The microscopic structure of these growths consists of cells—oval, angular, or elongated in shape; of large, round, oval, or flask-shaped irregular cells containing nuclei; and of free nuclei. The section of a myeloid tumour is smooth and shining, and of a yellowish hue, and has frequently blotches or stains of a crimson or brownish-pink

colour scattered over its surface. The treatment and diagnosis of these tumours are the same as those of cartilaginous growths.

Osseous Tumours.

Structure of.

These tumours almost always grow in connection with bone or periosteum, but they have occasionally been met with in the soft tissues. An osseous growth is usually called an "Exostosis."

Osseous tumours may be composed of compact bony tissue, or of cancellated texture, with an outer layer of compact bone, which varies in thickness in different cases. The former growth is termed an "Ivory" exostosis, the latter a "Cancellated" exostosis. An osseous tumour having a narrow neck, or attachment to a bone, is termed a "Pedunculated" exostosis.

Osseous tumours are most frequently developed from cartilage; occasionally, however, an exostosis is simply an outgrowth from the bone itself, or it may be an exaggeration of some natural process or ridge.

When the growth is developed from cartilage, its ossification commences at

*Structure of—
continued.*

the base, more and more cartilage being deposited at the circumference, so that such a tumour increases or grows from the circumference. An exostosis, which at first is connected with only the external surface of the bone, may, in time, by the absorption of this surface, become continuous in structure with the cancellated texture of the bone.

The *ivory* exostosis is rarely met with, except in connection with the bones of the skull. It is usually small in size, and is very dense and hard in texture. It most frequently grows from the outer table of the cranial bones. More rarely it affects the inner table, and sometimes it implicates both tables.

The *cancellated* exostosis may grow in connection with any of the bones. It usually occurs single ; but, occasionally, several or almost all the bones in the body are affected with these growths. These tumours may have a broad or narrow attachment to the bone. They have, in the majority of instances, one or more layers of cartilage on their circumference, and are

*Structure of—
continued.*

surrounded by a distinct fibrous capsule. A cancellated exostosis may grow to a large size ; sometimes such growths press upon, or displace, important nerves, blood-vessels, or other structures. In the first case they may cause paralysis or painful symptoms ; in the second, a swelling which simulates an aneurism ; and in the third, interference with the functions of the parts implicated. Occasionally an exostosis is detached from the bone from which it grows, so that it becomes a movable tumour, instead of being a fixed one.

Situations of.

The *ivory* exostosis is almost always found growing from the bones of the skull, and very rarely from the bones of the face.

The *cancellated* exostosis is most commonly met with at or near the extremities of the humerus, femur, tibia, and other long bones, and the distal end of the second phalanx of the great toe. This kind of exostosis is also met with in connection with other bones, either as a single or multiple growth.

Diagnosis of.

A tumour hard to the touch, of

*Diagnosis of—
continued.*

slow growth, and firmly connected to the bone by a neck, which varies in breadth and length in different instances.

Alterations in.

The structure of an exostosis rarely alters. Occasionally an accumulation of serous fluid takes place within the capsule of the growth which may cause the tumour to simulate a cyst.

Treatment of.

The *ivory* exostosis should, as a rule, not be interfered with. The *cancellated* exostosis, when causing inconvenience, may be removed, provided it is growing from a bone upon which it is safe to operate. When the neck of the tumour is narrow, the operation is very simple; it consists in exposing the tumour and surface of bone from which it grows, and sawing through the neck, or nipping it across with the bone forceps. If the tumour is situated near an articular surface, great care must be taken not to injure or cut into the capsular ligament of the joint. Should the attachment of the growth to the bone be broader, the same proceeding may be adopted, provided the case is otherwise favourable for such an operation. In cases not suitable for such

*Treatment of—
continued.*

an operation, and in which interference is called for, removal of the affected bone, or a portion of it, by excision or amputation, will be the proper treatment.

Vascular Tumours.

Structure of.

These growths are composed of arteries, veins, and capillaries, with more or less fibrous structure interspersed between them, or arranged so as to form cells or cavities which have a free communication with the vessels forming the tumour. In some growths the arteries predominate, in others the veins, and in others the capillaries. Hence vascular tumours are divided into *arterial*, *venous*, and *capillary*. The arrangement of the blood-vessels in vascular tumours varies in different instances. In some the vessels are enlarged, dilated, and tortuous; in others the vessels are arranged as in some of the natural erectile tissue (the corpus cavernosum penis, for example), while in others the arrangement of the vessels is irregular. An important fact in connection with vascular growths is, that however much enlarged the

*Structure of—
continued.*

vessels in the substance of the growth may be, they are usually of natural size before they enter the growth, although they may be more numerous. Vascular growths vary in their appearance, according to their composition. They are most frequently situated in connection with the skin and subcutaneous tissue, but are also met with in connection with the mucous membrane, and with deeper parts. When the tumour implicates the skin it causes discoloration of it, which may be bright red, more or less mottled or bluish. A vascular growth is generally soft, and when compressed its bulk can be diminished, the tumour regaining its natural size when the pressure is taken off. Vascular tumours which have many arteries in their structure also pulsate distinctly.

The *arterial* vascular tumour or "Aneurism by Anastomosis," as it is generally called, is composed principally of dilated and tortuous arteries. There are usually, also, some enlarged veins and capillaries in such growths, and the skin and areolar tissue surrounding them are either more or less

Structure of—
continued.

hypertrophied or atrophied. Arterial tumours are most common in the neck, temples, and scalp, in connection with the branches of the external carotid ; but they are occasionally met with in other regions. They pulsate distinctly.

Venous tumours are principally composed of enlarged and tortuous veins, mixed with more or less arterial and capillary structure. They are of a bluish colour, and generally occur in the skin, subcutaneous tissue, or mucous membrane ; more rarely they affect deeper structures.

The *capillary* tumours may be illustrated by the common "nævus," which is composed of a mass of enlarged capillaries, with more or less fibrous or connective tissue interspersed. In some cases the growth is surrounded by a distinct capsule. Several arteries enter the substance of these growths, and veins pass out of them. Capillary tumours are most common in the skin or subcutaneous tissue ; very frequently they involve both these structures. They are often congenital, or appear soon after birth. Most frequently these tumours continue to increase

*Structure of—
continued.*

(more or less rapidly) for some time, and then remain stationary, or gradually diminish and disappear.

Situation of.

The *arterial* tumour is most common in the neck, temples, and scalp; sometimes it is met with in other regions.

The *venous* tumour affects the skin or subcutaneous tissue of the face, neck, and extremities, and is occasionally found in other situations.

The *capillary* tumour is met with in connection with the skin and subcutaneous tissue of the head, face, trunk, and extremities.

Diagnosis of.

The *arterial* tumour occurs in the form of a mass of dilated arteries, which pulsate strongly. The skin above the tumour may or may not be discoloured or altered in thickness.

The *venous* tumour is distinguished by its blue colour, and by its softness and compressibility. The enlarged and tortuous veins, of which it is principally composed, can generally be seen or felt. There is not usually any pulsation in the growth.

The *capillary* tumour is usually of a bright red or mottled colour, soft

*Diagnosis of—
continued.*

and compressible to the touch, and involves the skin, subcutaneous tissue, or both.

*Alterations in
Structure.*

Vascular tumours are sometimes attacked with inflammation, ulceration, or sloughing, and, in consequence, may undergo a natural cure.

Cysts not unfrequently form in the substance of vascular growths.

Vascular tumours are also liable to atrophy, and may shrink very much, or gradually disappear entirely.

Treatment of.

The *arterial* tumour may, if small and circumscribed, be removed by the knife. In doing so, care must be taken not to cut into the substance of the growth, or serious hæmorrhage may result. If the growth is larger, or not circumscribed, its structure may be destroyed by the application of one or more ligatures, or, what is preferable, coagulation of the blood contained in the vessels composing it may be produced by galvano-puncture. If the tumour is large, portions of it may be successively treated.

The *venous* tumour is to be treated on the same principles as the arterial.

The *capillary* tumour should not be

*Treatment of—
continued.*

interfered with in infants and in children, unless it is growing very rapidly, or shows no tendency to diminish. If the child has not been vaccinated, vaccination may be performed on the tumour, so as to cause inflammation of its substance. The other methods employed for destroying a *nævus* are the application of one or more ligatures, the application of some strong caustic, such as nitric acid, galvano-puncture, or injection of an astringent fluid, such as the muriate of iron. The choice of these remedies must depend on the situation and extent of the growth.

General Considerations in regard to.

Malignant Tumours or Cancers.

The various forms of cancer must be considered in the majority of cases as merely local manifestations of a constitutional disease or "*cachexia*." This *cachexia* is not so marked in some forms of cancer as in others. Its symptoms are sometimes present prior to, or from the very commencement of, the local disease ; in other instances they do not show themselves until the local complaint has made some progress. The symptoms of the cancerous

General Considerations in regard to—continued.

cachexia are—emaciation, a pale leaden or yellow hue of the skin, and other signs of general disturbance.

Cancers have a distinct “tendency” (Paget) to be *hereditary*.

Tubercular disease would appear to have an intimate relationship with cancer. It is sometimes found combined with it in the same individual, and it is a proved fact that cancerous parents may beget children who become affected with tubercular disease, and also that parents suffering from tubercular disease may produce children who suffer from some form of cancer.

Women are more liable to cancerous disease than men, but this would appear to be owing to the frequency of the disease in the uterus and breast.

Persons of all conditions of life are equally subject to cancer. *Climate* and *Temperament* have been thought to have some influence on the frequency of cancerous disease. The inhabitants of Europe are said to be more liable to the disease than other nations.

Age determines somewhat the occurrence of cancer, and also the particular form of cancer. The liability to can-

General Considerations in regard to—continued.

cer gradually increases with age. Soft cancers are most frequent in early life; hard cancers rarely occur before the age of forty.

The *duration* of cancer varies considerably in different cases. Mr. Sibley found that in cancer of the breast the average duration was 53 months in those operated on, and 32 months in those not operated on.

Local injuries and irritations not unfrequently act as mere "excitants" in producing the local production of cancer in persons having a cancerous constitution, or a tendency to it.

Cancers are composed of cellular structures, some of which are like those occurring in natural tissues, others are "not like that of any of the fully-developed natural parts of the body." It is, therefore, more the arrangement than the appearance of these cellular elements which characterises the structure of a cancer. The characteristics of cancerous structure are—(1) Nucleated cells, free, and not embedded in any formed interstitial substance; (2) Arrangement of elements of structure in no defined order;

General Considerations in regard to—continued.

(3) Multiplicity of cells. Cancer cells vary in size and shape, as will be seen in the description of the varieties of cancer; their nuclei are always distinct, large, oval, or rounded.

Cancer cells may be suspended in a liquid ("cancer juice"), which may be thick and creamy, thin or glairy, like synovial fluid; or the stroma of a cancerous tumour may be formed of the tissues, soft or bony, in which the growth has originated. Occasionally, granular or other delicate tissue forms the stroma of a cancer.

The origin of the cells in cancer takes place, according to recent observations, in the pre-existing cells of the tissue affected.

Cancer when it first appears is termed "Primary;" that which follows the first growth is termed "Secondary." Cancer may, from the first, be "single," or "multiple." When cancer is "single," it may, according to Paget, involve other parts—(1) By continuity of structure; (2) By means of the lymphatics; (3) By transportation of cancer materials (by the venous blood) to the lungs or other internal organs.

General Considerations in regard to—continued.

Cancers, like other tumours, may be attacked with inflammation, and portions of, and occasionally their entire substance, may perish by sloughing. All cancers are very liable to ulceration, which is followed in some forms of the disease by a fungous protrusion.

Cancers may also undergo atrophy, or fatty degeneration. When a cancer grows in connection with bone or periosteum, ossification of more or less of its substance is very common.

No radical cure for cancer as a constitutional disease has as yet been discovered; but as experience proves that the removal of the local disease in favourable cases prolongs life, it is right that the surgeon should operate, *provided the local cancer is single, admits of entire removal or destruction, without immediate danger to life, and does not affect the lymphatic system or internal organs.* The removal of a local cancer under such circumstances may be accomplished by the knife (the most satisfactory), or by the application of some powerful caustic. In operating upon local cancer, either

General Considerations in regard to—continued.

by the knife or by caustics, it is of essential importance that the entire disease, and a margin of healthy tissue, be taken away or destroyed. When the disease, however limited, affects a gland (such as the breast) or a bone, the whole gland or bone should be removed, together with the cancer.

The only other treatment in cases of cancer is palliative, and consists in the use of sedatives, local or general, and attention to the health and diet, which latter should be as nourishing as possible. Should the cancer have ulcerated, lotions or washes containing Condyl's fluid, or other disinfectant, may be useful in preventing or lessening the offensiveness of the discharge; and if the ulcerated surface should bleed, the application of pressure and some astringent (as the muriate of iron) must be employed.

Scirrhus or "Hard" Cancer.

Structure of.

This form of cancer is distinguished by its peculiar hardness. It rarely attains a large size, and is not usually met with before the age of forty, although exceptional cases do occasionally occur. Sibley found that the

*Structure of—
continued.*

average age when it occurred in the female breast was 48·6 years.

A scirrhus tumour is irregular in shape, and shows no distinct limitation (occasionally, however, a scirrhus cancer is met with in the breast or other situations more circumscribed). Its section is of a greyish colour, frequently dotted with spots of yellow (fatty degeneration), and intersected with white fibrous lines or bands, and in some situations, as in the breast, with sections of gland tubes or other structures. If the surface of the section is scraped, abundance of creamy cancer juice is obtained.

The microscopic structure of scirrhus consists of large nucleated cells, usually angular or rounded in shape, infiltrated into the tissue of the affected part, which may be natural or more or less broken up or degenerated.

The substance of a scirrhus cancer has a great tendency to contract, and hence the cause of the drawing down or puckering of the skin and other textures in the region of a scirrhus growth. When the cancer affects a canal (such as the rectum or œsophagus),

*Structure of—
continued.*

the same cause produces more or less narrowing or stricture of it. Should the cancer originate in a gland such as the breast, portions of the gland structure disappear with greater or less rapidity. In some cases the entire gland is absorbed, the mass of cancer taking, as it were, its place.

Occasionally a scirrhus growth gradually shrinks and contracts, and may remain in this state for a long time without making any further progress. The growth of a scirrhus cancer varies in rapidity in different cases. In some its progress is very rapid, while in others it is much slower.

Situation of.

Most common in the female breast, and some portions (rectum and sigmoid flexure of the colon, for instance) of the intestinal canal. More rarely "primary" scirrhus cancer affects the skin, lymphatic glands, bones, and muscles, but these structures are most frequently attacked with "secondary" growths.

Diagnosis of.

A tumour hard and almost stone-like in consistence, having no distinct limitation, and situated in some of the

*Diagnosis of—
continued.*

regions mentioned. In addition, there is usually some drawing down or puckering, and adhesion of the skin and other tissues over the growth; and if the disease is situated in connection with the walls of a canal, there is more or less contraction of its calibre. If the patient is above forty years of age, it will be still further evidence that the growth is scirrhus in its nature. "Secondary" scirrhus cancer affecting the skin is generally met with in the form of hard tubercles, varying in size, and having the skin over them discoloured.

When bones are affected with scirrhus cancer, they are very liable to suffer fracture, as the disease gradually causes destruction of the osseous tissue.

*Alterations in
Structure.*

Inflammation and sloughing occasionally attack a scirrhus cancer, so that portions of its substance, and in rare cases, the whole growth, may perish. Ulceration is not so common in connection with scirrhus as in some other forms of cancer, but it does frequently occur, especially in cases where the disease is "secondary," and

Alterations in Structure—continued.

affects the skin or glands, or where the progress of the disease has been very rapid. The ulceration, when it is present, has the usual tendencies of cancerous ulceration—namely, to spread and involve surrounding tissues. Scirrhus growths occasionally undergo atrophy. Cysts also may form in the substance of these growths.

A scirrhus cancer sometimes assumes the characteristics of a “soft” or medullary cancer, grows rapidly, and attains a large size.

Treatment of.

Complete removal of the disease and a margin of healthy surrounding tissue with the knife, or destruction of the same with some strong caustic, provided the case is favourable for an operation (see general rules for treatment of cancer), and is situated in a region which admits of an operation being performed. When the disease, however limited, affects the breast or a bone, the entire gland or bone must be taken away, together with the growth. In cases not suitable for an operation, the symptoms can only be palliated.

*Structure of.***Medullary or "Soft" Cancer.**

This form of cancer is distinguished by its softness, the rapidity of its growth, and the size which it may attain. It is more vascular than scirrhus, and has a greater tendency to soften, ulcerate, and protrude in the form of a fungus.

Soft cancer frequently occurs before the age of forty, especially in the bones, testicle, eye, and intermuscular spaces. It is met with either as a circumscribed growth of a rounded or oval shape, which may be more or less lobulated, the lobules usually extending into the surrounding tissues, or spaces, or as an infiltration into the substance of a tissue or organ. A soft cancer, in its progress, will sometimes embrace, more or less completely, or follow the course of nerves, blood-vessels, or other important structures.

The section of a soft cancer is white, light grey, resembling brain structure (hence the term "Encephaloid" cancer), or pinkish in colour. Not unfrequently there are patches of blood scattered through it. Some portions

*Structure of—
continued.*

of the tumour are usually softer than others, and cysts, varying in size and number, are often scattered through its substance. When the section is pressed or scraped, it yields abundant creamy cancer juice. The microscopic structure of a soft cancer consists of nucleated cells suspended in fluid, embedded in soft stroma, or into the tissues of the affected part.

The cells may be rounded, oval, irregular, or elongated in shape, and contain one, two, or more nuclei. Free nuclei, varying in shape, are also generally present in soft cancers. As a rule, the cells in a soft cancer are more loosely grouped together and their stroma more fluid than in hard cancer.

Situation of.

Most common in connection with the bones and periosteum, the testicle, eye, and intermuscular spaces. It occurs less frequently in the breast and lymphatic glands as a primary disease.

Diagnosis of.

A soft elastic tumour of rapid growth, occurring in some of the situations referred to. The consistence of a soft cancer is not always the same, but some tumours feel much softer than others. When growing in connec-

*Diagnosis of—
continued.*

tion with a bone or its periosteum the tumour may feel very hard in part or in whole. The elastic feel of a soft cancer is often very like that caused by the presence of fluid confined in a cyst, or otherwise enclosed; but the introduction of an exploring needle will settle the point. Soft cancers which are very vascular sometimes pulsate, and their bulk can be diminished by compression, so that such growths may be mistaken for vascular tumours, or even for aneurisms.

The rapid growth and progress of the cancer is, however, usually sufficient to distinguish it from these other affections.

*Alterations in
Structure.*

The substance of a soft cancer is very liable to inflammation, ulceration, and sloughing, more especially when the skin over the growth has given way, and it protrudes in the form of a fungus. Such a fungus is soft, ulcerates, or sloughs, and has usually a great tendency to bleed. Very frequently the protruding mass is infiltrated with blood, and constitutes what is termed a "Fungus Hæmatodes." Soft cancers occasionally undergo atro-

Alterations in Structure—continued.

phy or withering. They also undergo fatty or calcareous degeneration, and when growing in connection with bone or periosteum, ossification of a greater or less amount of their substance frequently takes place.

Treatment of.

The same as that of scirrhus and other cancers.

Structure of.

Epithelial Cancer, or “Epithelioma.”

The characteristics of this form of cancer are, according to Paget, that it is chiefly composed of cells which resemble those of the scaly epithelium lining the interior of the lips and mouth, and that these cells are infiltrated in the interstices of the proper structures of the skin or other affected tissue. Epithelial cancer is almost always met with in connection with the skin or mucous membrane. It occurs in these situations either as a hard lump, frequently ulcerated on its summit, and varying in size and depth, or in the form of a warty growth (the “papillary” form), with more or less hardness round its base. In the latter form of the disease, the natural papillæ of the

*Structure of—
continued.*

skin or mucous membrane are enlarged and otherwise altered. A section made through the substance of an epithelial cancer is firm, and of a greyish-white or white colour.

The microscopic structure of epithelial cancer consists of flattened cells of a rounded, oval, or irregular shape, containing nuclei, of free nuclei, of endogenous cells, and of laminated epithelial globes or capsules. The cancer fluid scraped from the section of an epithelial tumour is usually thick and curdy in appearance.

Although epithelial cancer usually commences in the superficial textures, it may in its progress involve the deeper parts. The progress of this kind of cancer is not generally so rapid as in the other forms of cancer, and the constitutional cachexia is rare, unless the local disease has made some progress.

Situations of.

Very common in connection with the skin or mucous membrane of the face, lips (especially the lower lip), tongue, prepuce, scrotum, labia, and os uteri. It also occurs in connection with the skin or mucous membrane of other regions, with cicatrices, and with

*Situations of—
continued.*

long-standing warts or ulcers. Occasionally epithelial cancer originates in the deeper textures.

Diagnosis of.

An undefined mass, firm and hard to the touch, or a warty growth, having a hardness round its base, growing in connection with the skin or mucous membrane. Very frequently the growth presents an ulcerating surface, or a scab on its summit; and round about this ulceration or scab the distinct hardness caused by the substance of the tumour is felt.

*Alterations in
Structure.*

An epithelial cancer may be attacked with inflammation, and it is very liable to ulceration, which has the usual characteristics of cancerous ulceration.

Treatment of.

The same as that of other cancers.

Colloid Cancer.

This cancer is distinguished by its being composed of a soft, jelly-like substance (colloid substance), surrounded and intersected by more or less fibrous tissue. Sometimes the fibrous tissue is arranged in the form of partitions, which enclose cavities containing the colloid matter. The proportion of col-

loid substance and fibrous tissue varies in different tumours, and determines the consistence of the growth. The colloid substance is glistening, of a pale-yellow, pink, brown, or green hue. Its microscopic structure consists of nucleated cells, lying free or enclosed in large brood-cells, and of laminated spaces, between the lamellæ of which lie clusters of small nucleated cells and nuclei. These growths may attain a large size. Their "malignant" tendencies are not so strongly marked as in some of the cancers.

Situations of.

Most common in the intestines, stomach, or other internal organs; more rarely it occurs in the breast and subcutaneous tissue.

Diagnosis of.

Colloid cancer is not easily distinguished from other malignant tumours without an inspection of the substance of the tumour; but this is of little consequence, as its treatment is that of other cancerous growths.

Melanotic Cancer.

Structure of.

This growth is characterised by its colour, which is dark-grey, brown, or black. The majority of melanotic

<i>Structure of— continued.</i>	<p>tumours are medullary or soft cancers, with the addition of pigment cells. The section of a melanotic tumour varies in colour, and different portions of the same growth also vary in shade. The peculiar microscopic structure of a melanotic growth is, molecules and granules of pigment, free, or contained in nuclei or cells.</p>
<i>Situation of.</i>	<p>When melanotic cancer is secondary it is often scattered over almost the whole body in the form of masses or tubercles. Most common in the skin and subcutaneous tissue, especially in connection with moles ; and in the eye.</p>
<i>Diagnosis of.</i>	<p>A tumour, soft and elastic, of a brown or black colour, growing in connection with the skin, subcutaneous tissue, or eye, and showing the same tendencies as medullary cancer.</p>
<i>Treatment of.</i>	<p>The same as that of other cancers.</p>

Osteoid Cancer.

This form of cancer affects the bones, and is distinguished by the formation of dense osseous matter in the substance of the growth, and also by the occurrence of secondary deposits of similar osseous structures in the lymphatic

glands, lungs, and occasionally in other parts of the body.

Structure of.

The structure of these growths is usually a mixture of soft medullary cancer, and of this hard osseous material, the latter of which is scattered more or less completely and in masses varying in size through the substance of the former.

*Diagnosis and
Treatment of.*

The diagnosis of this disease is that of cancer affecting bone, with the addition of the secondary osseous deposits; and the treatment is the same as advised in the other forms of cancer which affect bone.

A form of disease which is principally met with in connection with the mucous membrane of the bladder and rectum, has been termed *villous cancer*. Its peculiar microscopic structure shows a stem with branches, from which there sprout out flask-shaped buds, which may contain serous fluid, glandular tissue, or cancerous structure; but recent observations have shown that this villous condition is met with in connection with non-cancerous affections.

ABSTRACTS
OF
SURGICAL PRINCIPLES.

BY
THOMAS ANNANDALE, F.R.S. & F.R.C.S. (Ed.)

— ♦ —
PART III
DISLOCATIONS.



SECOND EDITION.

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PREFACE.

THESE Papers were originally printed solely for the use of gentlemen attending my Class of Systematic Surgery ; but having been frequently requested to make them more public, I am induced to place them within the reach of the Medical Students of Edinburgh, with the sincere wish that they may be found an assistance in the study of some of the important principles of Surgery.

My object in preparing these Papers has been to give a concise abstract of the subjects treated of in a form intelligible to the youngest student.

It has certainly not been my intention that these Abstracts should take the place of more extended works on Surgery ; but it is my hope that a study of them will promote a better understanding of such works and their contents.

THOMAS ANNANDALE.

ABSTRACTS OF SURGICAL PRINCIPLES.

DISLOCATIONS.

Definition of.

Dislocation.

A displacement of one articular surface of a bone from another.

Terms used in connection with.

Simple, when there is no external wound of the soft parts communicating with the injured joint.

Compound, when there is an external wound of the soft parts communicating with the joint.

Complicated, when there is some other injury present, as a fracture, rupture of an artery, nerve, &c. &c.

Partial, when some portion of the articular surfaces remains in contact.

Complete, when no part of the articular surfaces is in contact.

Reduced, when the displaced surfaces have been returned to their proper position.

Unreduced, when the displaced surfaces have not been so returned.

*Terms used—
continued.*

Upwards, Downwards, Backwards, Forwards, Lateral, Outwards, Inwards.—These terms are used to explain the direction of the displacement, and refer to the bone or bones that are situated at the distal end of the injured joint.

Causes of Dislocations.

- (1.) External violence.
- (2.) Disease.
- (3.) Congenital.

External violence may produce a dislocation *directly* (as when a person falls on his shoulder and dislocates his shoulder joint), or *indirectly* (as when a person falls on his elbow and dislocates his shoulder joint).

Muscular action occasionally produces a dislocation, but this is a rare cause, and more frequently acts in completing or determining the direction of the displacement after it has occurred.

Dislocations, the result of external violence, will only be here considered.

General and Characteristic Symptoms of a Dislocation.

- (1.) Alteration in the shape of the in-

jured joint, and a change in the relation of the articular ends of the bones to one another.

(2.) Alteration in the length and direction of the axis of the affected limb.

(3.) Partial or complete loss of the power of moving the injured joint, especially in certain directions.

(4.) Absence of *true* crepitus.

(5.) If the dislocation is reduced the symptoms disappear.

In addition, there may be pain, swelling, and other symptoms, the result of the pressure of the displaced bones upon blood-vessels, nerves, or other important structures.

It is important to note that if the dislocation is not reduced within a few days after the accident many of the symptoms become less marked.

General Treatment of Dislocations.

If the dislocation is a *simple* one, replace the articular surfaces in their natural position as soon as possible.

In doing this, it is necessary to ascertain carefully the direction of the displacement, so that extension or

*Treatment—
continued.*

manipulation may be employed in a way that will best tend to *reduce* the dislocation. Any muscles or tendons that are acting as agents in preventing reduction should be relaxed as much as possible by attending to the position of the limb, or by administering chloroform, or other agent, so as to produce its complete anæsthetic effect.

If the dislocation is *compound*, it is often advisable (especially if a movable joint is of importance) to saw off more or less of the articular surfaces implicated, in order to accomplish reduction more readily, and then to treat the case as one of excision of the joint.

Complicated dislocations must be treated according to their nature. If the complication is a simple fracture, first apply splints, so as to fix the ends of the broken bone, and then endeavour to reduce the displaced articular surfaces.

If a large artery has been ruptured, it must be tied at the situation of the rupture, provided the presence of other complications does not demand amputation. When the complications are more serious, amputation will usually be necessary.

*Treatment—
continued.*

When a dislocation has been reduced, the injured joint must be kept at rest for from one to three weeks, according to the joint involved, and, if necessary, proper apparatus used to keep the bones in their natural position until the ligaments have healed. After this, careful movements of the joint should be practised.

SPECIAL DISLOCATIONS.

Dislocations of the Lower Jaw.

(1.) *Bilateral*, or dislocations of the jaw on both sides (most common).

(2.) *Unilateral*, or dislocation of the jaw on the one side only.

In both these forms the dislocation is *forwards*.

Symptoms of.

Bilateral.—Mouth open, jaw fixed, or nearly so, and slightly advanced, inability to articulate, and a hollow in front of the ears.

Reduction of.

Take a firm hold of the lower jaw with both hands, one thumb, protected by some soft substance (such as a towel), being placed inside the mouth over the molar teeth on each side, the

*Reduction of—
continued.*

fingers remaining outside, and grasping the bone at its angle. When the jaw has thus been firmly laid hold of, draw its angles downwards and backwards, and then tilt up the chin. When reduction is difficult, first reduce one side, and then the other.

Symptoms of.

Unilateral.—Mouth open, but not so much as in the bilateral dislocation. Jaw fixed, or nearly so, some lateral deviation of the chin to the opposite side from that which is displaced and a marked hollow in front of ear on side dislocated.

Reduction of.

The same as in the bilateral, acting, however, principally on the injured side.

Dislocations of the Clavicle.

(A.) Sternal	{	(1.) Forwards (most common).
end.		(2.) Upwards (rare).
		(3.) Backwards (rare).

Forwards.*Symptoms of.*

The displaced end of the bone can be seen and felt in front of the sternum, and there is more or less interference with the movements of the arm.

Reduction of.

Draw the shoulders well back, and push back the bone into its place.

When this has been done, it is necessary to apply for two or three weeks some apparatus which will keep the bone in position. One method which will aid in keeping this bone in position, in this and other of its dislocations, is to apply a pad after the principle of a truss in addition to the means employed to draw back the shoulders and support the arm. Even with the use of an apparatus, the bone in all these dislocations usually remains more or less displaced ; but, notwithstanding, the arm will in time regain its usefulness.

Upwards and Backwards.*Symptoms of.*

Both these rare forms of dislocation can usually be detected by feeling or seeing the displaced bone in its unnatural position. There is also more or less interference with the movements of the arm on the injured side, and in the latter dislocation the displaced bone may give rise to symptoms of pressure on the trachea, œsophagus, or sub-clavian artery.

Reduction of.

Endeavour to return the displaced bone by drawing back the shoulders, and then keep the patient flat on his back, or employ some apparatus to retain the dislocated bone in position until the ruptured ligaments have healed. These dislocations do not usually continue perfectly reduced, but the bone remains more or less displaced.

(B.) Acromial end. { (1.) *Upwards* (most common).
(2.) *Downwards* (rare).

Upwards.*Symptoms of.*

The end of the clavicle can be felt displaced above the acromion process, and the clavicle itself is more movable than natural. There is generally some difficulty in raising the arm to a right angle with the body.

Reduction of.

Return the displaced bone by pressing it down into its proper place. If simple pressure is not sufficient, draw back the shoulder. When the bone is reduced, apply a bandage and pad over the shoulder and support the arm. If the dislocation has been complete, the bone usually remains displaced, but

*Reduction of—
continued.*

the usefulness of the arm gradually returns.

Downwards.

Symptoms of.

The displaced bone is felt under the acromion process, and there is difficulty in raising the arm.

Reduction of.

Draw the shoulders outwards and backwards. When the bone is replaced, apply a bandage round the chest, so as to fix the scapula, and adjust a pad and bandage over the shoulder.

Dislocations of the Shoulder Joint.

(1.) Downwards (most common).

(2.) Forwards.

(3.) Backwards (rare).

Downwards (sub-glenoid).

Symptoms of.

Flattening of the shoulder with a distinct depression under the acromion process. The elbow separated from the side, and sometimes directed a little backwards. Inability to move the arm, especially inwards. The head of the bone can be felt in the axilla, and moves with the shaft; the arm is lengthened nearly an inch, and there

*Symptoms of—
continued.*

Reduction of.

is pain, swelling of the limb, and numbness of the hand and fingers.

If the dislocation is recent, raise the arm from the side so as to relax the deltoid and other muscles, fix the scapula, and then extend the arm in a direction at right angles to the body.

When this method does not succeed, lay the patient on his back, place the heel in the axilla so as to fix the scapula, and then extend the arm in a direction downwards; rotating the arm a little, during the extension, is often useful in assisting the bone into its place. If the bone cannot be replaced in this way, the pulleys must be used by fixing the scapula and shoulder with a belt or band passed under the axilla, and then extending the arm downwards.

Forwards (may be sub-coracoid or sub-clavicular).

In this dislocation the head of the bone may lie underneath the coracoid process or under the clavicle.

Symptoms of.

A depression under the acromion process; the elbow separated a con-

*Symptoms of—
continued.*

siderable distance from the side ; the axis of the limb quite altered, and the head of the bone felt underneath the coracoid process, or under the clavicle. The symptoms are most marked when the head of the bone lies under the clavicle.

Reduction of.

These dislocations may sometimes be reduced by raising the arm, fixing the scapula, and extending it outwards, as in the dislocation downwards. If this does not succeed, extend the arm backwards and in a direction downwards, the heel being placed in the axilla against the scapula.

Backwards (sub-spinous).

Symptoms of.

A depression under the acromion process, a space between the head of the bone and the coracoid process, the humerus rotated inwards, the forearm lying across the chest, and the head of the bone felt under the spine of the scapula.

Reduction of.

Fix the scapula by means of the heel, or a belt, and extend the arm downwards and slightly outwards or forwards.

Dislocations of the Elbow Joint.

(A.) Both radius and ulna. { (1.) Backwards.
(2.) Outwards.
(3.) Inwards (rare).
(4.) Forwards (very rare).

(B.) Of radius alone. { (1.) Forwards.
(2.) Backwards.

(C.) Of ulna alone. { Backwards (very rare).

(A.) **Backwards** (radius and ulna).

Symptoms of.

Arm fixed in a slightly flexed position; the olecranon process and head of the radius felt projecting upwards and backwards behind the joint, and their relation to the condyles of the humerus altered, and the lower end of the humerus prominent in front. If an attempt be made to flex the arm, the olecranon will project more; but if the arm is extended, the prominence of this process becomes less marked.

Reduction of.

The arm being fixed, forcibly extend the forearm and at the same time push down the displaced bones into their place. If this does not succeed, place the knee against the front of the elbow-

*Reduction of—
continued.*

joint, and press against the radius and ulna, so as to separate them from the humerus, and then gradually and forcibly flex the arm.

(A.) **Outwards** (radius and ulna).

Symptoms of.

Arm fixed in a slightly flexed position; forearm pronated; the internal condyle of the humerus projects, and there is a deep hollow below it; the head of the radius projects on the outer side, and the olecranon projects behind. The dislocation is not usually a *complete* one.

Reduction of.

Extension of the forearm, with pressure on the displaced bones, so as to push them into their proper position.

(A.) **Inwards** (radius and ulna).

Symptoms of.

The forearm more or less flexed and fixed; the outer condyle of the humerus prominent; the olecranon projecting on the inner side.

Reduction of.

Extension of the forearm, with pressure on the displaced bones.

(A.) **Forwards** (radius and ulna).

Symptoms of.

Arm fixed at a right angle; the extremity of the humerus projecting behind instead of the olecranon.

Reduction of.

Extension of the arm, and if this is not successful, forcible flexion should be employed.

(B.) **Forwards** (radius alone).

Symptoms of.

The forearm pronated, or nearly so, slightly flexed, and cannot be extended without pain; the head of the radius felt projecting in front of the humerus, and moving there when the forearm is rotated.

Reduction of.

Extension of the forearm, with pressure on the displaced bone, so as to push it down into its place.

(B.) **Backwards** (radius alone).

Symptoms of.

Forearm slightly flexed and pronated, and the head of the radius felt behind the outer condyle of the humerus.

Reduction of.

Extension of the forearm, with pressure on the head of the radius.

(C.) **Backwards** (ulna alone).

Arm flexed more or less, and pronated; the olecranon projecting behind, and the head of the radius in its proper position.

Reduction of.

Extension of the forearm, or forcibly

*Reduction of—
continued.*

bending the elbow across the knee, as in the case of a dislocation of both bones backwards.

Dislocations of the Wrist Joint
(*rare*).

- (A.) Of carpal bones { (1.) Forwards.
 (2.) Backwards.
(B.) Of lower end of { (1.) Backwards.
 ulna. (2.) Forwards.

(A.) Forwards.

Symptoms of.

Projection of the lower ends of the radius and ulna on the back of the hand, absence of any crepitus.

Reduction of.

Fix the forearm and forcibly extend the carpus by grasping the hand.

(A.) Backwards.

Symptoms of.

Projection of the lower ends of the radius and ulna on the palmar aspect of the wrist, absence of any crepitus.

Reduction of.

Same as the last.

(B.) Forwards.

Symptoms of.

Hand supinated, the end of the ulna projecting on the front of the wrist.

Reduction of.

Extension of the hand and pressure on the displaced bone, so as to push it into its position.

<i>Symptoms of.</i>	(B.) Backwards. Hand fixed midway between pronation and supination, the end of the ulna projecting on the back of the wrist.
<i>Reduction of.</i>	Extension of the hand and pressure on the displaced bone.
	Dislocations of the Carpo-Metacarpal Joints. These are most common in the thumb, and may be— (1.) Backwards. (2.) Forwards.
<i>Symptoms of.</i>	Backwards. Thumb shortened, and the end of its metacarpal bone projects on the dorsal surface of the trapezium.
<i>Reduction of.</i>	Fix the hand, extend the thumb, and return the bone to its place by manipulation.
<i>Symptoms of.</i>	Forwards. Thumb shortened, and the end of its metacarpal bone projects on the palmar surface of the trapezium.
<i>Reduction of.</i>	By extension and manipulation as in the last injury. It is better in both these dislocations

*Reduction of—
continued.*

to apply a splint for some time, so as to retain the bone in its position, for it has a great tendency to become displaced again.

Dislocations of the Metacarpophalangeal Joints.

These injuries most frequently affect the thumb, and may be—

- (1.) Backwards (most common).
- (2.) Forwards.

Backwards.

Symptoms of.

The thumb or finger shortened, and the end of the first phalanx projecting on the dorsal surface of its metacarpal bone.

Reduction of.

By extension of the injured thumb, or finger, and pressure on the displaced bone. If this does not succeed, forcibly flex to the full extent the thumb, or finger, and then endeavour to manipulate the displaced bone into its natural position.

Forwards.

Symptoms of.

Thumb or finger shortened, and the end of the displaced bone projecting on the palmar surface of the metacarpal bone.

Reduction of.

Same as in the dislocation backwards.

Dislocations of the Phalangeal Joints.

- (1.) Backwards.
- (2.) Forwards.

Symptoms of both.

Thumb or finger shortened, and the end of the displaced bone projecting on the dorsal or palmar aspect of the proximal phalanx, according to the direction of the dislocation.

Reduction of both.

By extension of the injured digit and pressure on the end of the displaced bone, and if this fails, extreme flexion and manipulation should be employed.

Dislocations of the Hip Joint.

- (1.) Upwards.
 - (2.) Backwards.
 - (3.) Downwards.
 - (4.) Forwards.
- } Most common.

In addition, rarer forms of dislocation occasionally occur at this joint; these are *directly upwards*, *directly downwards*, and *forwards into the perineum*.

*Symptoms of.***Upwards** (on the dorsum ilii).

Limb shortened from one to two and a-half inches and fixed, or nearly so, with the thigh slightly bent and turned inwards, so that the knee rests against the opposite thigh, and the great toe upon the instep of the opposite foot; the thigh may be flexed but cannot be abducted, the head of the femur can be felt on the dorsum ilii. In rare cases the limb is *everted* in this dislocation and also in the dislocation backwards.

Reduction of.

By manipulation. This is performed by flexing the leg upon the thigh, and the thigh upon the abdomen, rotating the limb outwards with a sort of sweep, and then extending it so as to manipulate the head of the bone into the acetabulum.

If this method does not succeed, the limb must be extended by means of the pulleys, in a direction downwards, and slightly across the opposite thigh.

Before employing extension in any of the dislocations of the hip, the pelvis must first be fixed by a belt or band.

	Backwards (into the great ischiatic notch).
<i>Symptoms of.</i>	Limb shortened about half-an-inch, thigh turned inwards, and fixed as in the dislocation upwards, only not to so great an extent. The thigh is also slightly flexed, and when the patient is lying flat on his back, the limb cannot be properly extended. The head of the femur rests over the sciatic notch.
<i>Reduction of.</i>	By manipulation, as in the dislocation upwards ; or, if this fails, extension with the pulleys in a direction downwards, and across the opposite thigh, must be made.
	Downwards (into the foramen ovale).
<i>Symptoms of.</i>	Limb <i>lengthened</i> from one to two inches, thigh flexed and abducted, and the injured limb is advanced in front of the opposite one.
<i>Reduction of.</i>	By manipulation, the limb being, however, rotated <i>inwards</i> instead of outwards, as in the other dislocations. If this plan fails, the pelvis must be fixed and extension of the upper part of the thigh made with the pulleys in a direction upwards and outwards, the

*Reduction of—
continued.*

foot and ankle being then abducted, so as to manipulate the head of the femur into the acetabulum.

Symptoms of.

Forwards (on to the pubes).

Limb shortened and fixed, rotated outwards, slightly flexed, and the head of the femur felt on the pubes.

Reduction of.

By manipulation and pressure on the displaced bone, so as to push it down towards the acetabulum. If this plan fails, extension with the pulleys in a direction downwards and slightly outwards.

Dislocations of the Knee Joint (rare).

- | | | |
|----------------------|---|-----------------|
| (A.) Of the patella. | { | Outwards. |
| | | Inwards. |
| (A.) Of the head | { | (1.) Backwards. |
| of the tibia. | | (2.) Forwards. |
| | | (3.) Outwards. |
| | | (4.) Inwards. |

(A.) **Outwards** (patella).

Symptoms of.

Joint fixed and slightly bent, and the patella felt lying in front of the outer condyle of the femur.

Reduction of.

Flex the thigh upon the abdomen, and press the displaced bone into its proper position.

(A.) **Inwards** (patella).

Symptoms of.

Joint fixed, and the patella felt lying in front of the inner condyle of the femur.

Reduction of.

The same as in the dislocation outwards.

The patella is occasionally displaced edgeways, and is to be reduced in the same way.

(B.) **Backwards** (tibia).

Symptoms of.

The condyles of the femur project in front, and the head of the tibia is felt in the popliteal space.

Reduction of.

Flexion of the knee and manipulation; or, if these fail, extension of the limb in a direction downwards, the thigh being fixed.

(B.) **Forwards** (tibia).

Symptoms of.

The condyles of the femur project behind, and the heads of the tibia and fibula, together with the patella, in front.

Symptoms of.

Reduction of.

(B.) Outwards. Inwards. (Tibia.)

The outer or inner condyle and the head of the tibia project on the outer or inner side of the joint, according to the direction of the dislocation.

Extension of the knee, and, if this fails, flexion and pressure on the displaced bone.

Dislocation of the Fibula.

The head of the fibula may be dislocated *backwards* or *forwards*. These dislocations are best reduced by flexing the knee and pushing the bone into its place.

Dislocations of the Ankle Joint
(Usually associated with fracture of the fibula, tibia, or of both.)

The foot may
be displaced { (1.) Outwards.
(2.) Inwards.
(3.) Backwards.
(4.) Forwards.

Outwards. (Dislocation of tibia
inwards.)

Symptoms of.

The sole of the foot is turned down-

*Symptoms of—
continued.*

wards and outwards, and the inner maleolus projects on the inner side of the joint. There is usually also a fracture of the lower end of the fibula, and sometimes also of the internal maleolus, so that the symptoms of fracture will be present in addition to those of the dislocation.

Reduction of.

Flex the leg upon the thigh so as to relax the muscles of the calf, and draw the displaced foot into position. Then apply a splint to keep the fractured bone or bones in their place, and to prevent the foot becoming again dislocated. When the foot is replaced, the limb is best treated in the straight position.

Inwards. (Dislocation of tibia
outwards.)

Symptoms of.

Foot displaced inwards, external maleolus projects on the outer side of the joint, and there are usually signs of fracture of the fibula or lower end of the tibia.

Reduction of.

The same as in the dislocation outwards.

	Backwards. (Dislocation of Tibia <i>forwards.</i>)
<i>Symptoms of.</i>	Foot shortened, the heel is more prominent, and is drawn up, and the lower end of the tibia can be felt lying on the dorsum of the foot. The signs of fracture of the lower end of the fibula, tibia, or both are, in the majority of cases, present.
<i>Reduction of.</i>	Flex the leg, and, by extension and manipulation of the foot, reduce the displacement. Then apply a "horse-shoe," or other splint, to the anterior surface of the leg, so as to retain the foot in its proper position.
	Forwards (very rare). (Dislocation of tibia <i>backwards.</i>)
<i>Symptoms of.</i>	Foot increased in length, heel less prominent, and the end of the tibia projects behind.
<i>Reduction of.</i>	Flex the leg, extend the foot, manipulate the displaced bone into position, and then apply some apparatus to keep it so.

Dislocations of the Tarsal Joints.

- (A.) Of the astragalus.
- (B.) Of the os calcis.
- (C.) Of the other tarsal bones.

(A.) The astragalus may be dislocated—

- (1.) Forwards.
- (2.) Backwards.
- (3.) Outwards.
- (4.) Inwards.

Symptoms of.

These dislocations are most frequently compound, and the displaced bone can, therefore, be seen or felt. When the dislocation is simple, the displaced bone will project on one or other aspects of the joint, according to the direction of the dislocation, and there will be more or less distortion of the foot. The dislocations of this bone may be complicated with fracture of the lower end of the tibia, fibula, or of both.

Reduction of.

Flex the leg, extend the foot, and endeavour to press the bone into its place. The reduction of this dislocation is often difficult and sometimes impossible. It may be assisted by the subcutaneous division of the tendo-achillis in obstinate cases.

*Reduction of—
continued.*

When the dislocation is compound or complicated, it is on the whole best to excise the displaced bone, or amputate the foot, according to the extent of the injury.

(B.) The os calcis may be dislocated *outwards*.

Symptoms of.

The foot turned inwards, and the displaced bone projecting.

Reduction of.

Flexion of the leg, extension of the foot, and pressure of the bone into its place.

(C.) The scaphoid or cuneiform bones are occasionally dislocated separately or together.

Symptoms of.

Projection of the displaced bone or bones.

Reduction of.

Extension of the foot and pressure on the displaced bone or bones.

Dislocations of the Tarso-Metatarsal Joints.

Symptoms of.

One, two, or all of the metatarsal bones may be dislocated.

When all the metatarsal bones are dislocated, the foot is shortened, and the displaced bones form a prominent ridge. When only one or two of these bones are displaced, the dislocated

*Symptoms of—
continued.*

Reduction of.

bone or bones will project more or less.

Extension of the foot, combined with pressure on the displaced bone or bones.

Dislocations of the Metatarso-Phalangeal Joints (*rare*).

The direction of these dislocations is usually *backwards*. One or more of the bones may be displaced.

Symptoms of.

The end of the displaced phalangeal bone projects and overlaps to a greater or less extent the metatarsal bone.

Reduction of.

Extension and manipulation, or flexion and manipulation.

Dislocations of the Phalangeal Joints (*rare*).

Usually backwards.

Symptoms of.

The toe shortened, and the dislocated bone projects and overlaps the proximal phalanx.

Reduction of.

Extension and pressure on the displaced bone. If this fails, forcible flexion of the toe may be tried.

Dislocations of the Vertebrae.

Simple dislocations of the vertebrae are rare, for these injuries are generally

complicated with fracture. Uncomplicated dislocations, when they do occur, are most common in the cervical and dorsal regions, especially in the former. The displacement may be—

- (1.) Backwards.
- (2.) Forwards.
- (3.) Lateral.

Symptoms of.

If the dislocation is in the upper part of the cervical region, immediate death may result. If it is in the lower cervical region, there will be, in the majority of cases, paralysis, more or less complete, of the upper and lower extremities, and of the bladder, and difficulty in respiration, death taking place in a few days. When the injury affects the dorsal region, there will be paralysis of the lower extremities and bladder, and rectum; and, in most instances, death results sooner or later.

Reduction of.

A few cases are on record in which reduction of such injuries has been successfully accomplished by extension of the neck or back and manipulation; but such reduction has serious risks, and, if attempted, should be very carefully performed.

Injuries in the Neighbourhood of some of the Joints, which may be Mistaken for Dislocations, with the Characteristic Symptoms of each.

SHOULDER JOINT.			
<i>Dislocations.</i>	<i>Bruises.</i>	<i>Fractures of the Neck of the Humerus.</i>	<i>Fracture of the Neck of the Scapula (rare).</i>
<p>(1.) Mobility diminished.</p> <p>(2.) Well-marked depression under acromion.</p> <p>(3.) No crepitation.</p> <p>(4.) The head of the bone felt in the axilla, under the coracoid process, clavicle, or spine of the scapula.</p> <p>(5.) When the head of the bone has been reduced, it remains so.</p> <p>(6.) Elbow cannot be placed against the side.</p> <p>(7.) The hand of injured arm cannot be placed on opposite shoulder.</p>	<p>(1.) Mobility not interfered with.</p> <p>(2.) Slight flattening of the shoulder.</p> <p>(3.) No crepitation.</p> <p>(4.) The head of the bone in its proper place.</p> <p>(5.) Elbow in natural position.</p>	<p>(1.) Mobility natural or increased.</p> <p>(2.) Depression under acromion slight or not present.</p> <p>(3.) Crepitation when arm is rotated.*</p> <p>(4.) The head of the bone in its place, but it does not move with the shaft. When the fracture is through the surgical neck, the end of the shaft most frequently projects upwards and inwards towards the coracoid process.</p> <p>(5.) Elbow can be readily brought against the side.</p> <p>(6.) Hand of injured arm can be placed on opposite shoulder.</p>	<p>(1.) Mobility increased.</p> <p>(2.) Depression under acromion slight.</p> <p>(3.) Crepitation when arm is raised and rotated.</p> <p>(4.) The head of the bone in the axilla, and moves with the shaft.</p> <p>(5.) When the head of the bone is reduced, it does not remain so, but falls down again into axilla, along with the neck of the scapula.</p> <p>(6.) Elbow can be easily brought against the side.</p>

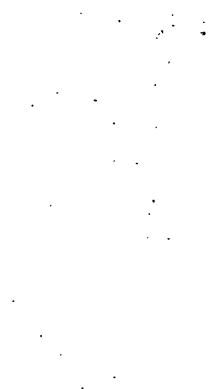
* When the injury is a separation of the epiphysis, the crepitation is softer in character.

WRIST JOINT.		ELBOW JOINT.	
<i>Dislocations.</i>	<i>Fractures of Lower End of Radius.</i>	<i>Dislocations.</i>	<i>Fractures of Lower End of Humerus.</i>
<p>(1.) Very rare.</p> <p>(2.) The displaced carpus forms a well-marked prominence on the dorsal or palmar aspect of the wrist, according to the direction of the dislocation.</p> <p>(3.) When the dislocation is reduced, it remains so.</p> <p>(4.) No crepitation.</p>	<p>(1.) Very common.</p> <p>(2.) The prominence caused by the fractured radius does not project so much as that which is the result of dislocation, and the hand is displaced towards the radial side.</p> <p>(3.) When the bone is replaced, it does not remain in position unless some means be used to keep it so.</p> <p>(4.) Crepitation when the fractured ends of the bone are brought in contact.</p>	<p>(1.) Mobility of the joint in certain directions diminished.</p> <p>(2.) The displaced bone, felt in their abnormal position, and when properly reduced, they remain in their natural place.</p> <p>(3.) No crepitation.</p> <p>(4.) Relation of the radius and ulna to the condyles of the humerus more or less altered.</p>	<p>(1.) Mobility of the joint increased or unaltered.</p> <p>(2.) When the displaced bone or bones are reduced, they do not remain so unless some means be used to keep them in position.</p> <p>(3.) Crepitation when the ends of the fractured bone are brought in contact.</p> <p>(4.) The relation of the radius and ulna to the condyles of the humerus not altered.</p>

HIP JOINT.			
Dislocations.	Bruises.	Intra-Capsular Fracture of the Neck of the Femur.	Extra-Capsular Fracture of the Neck of the Femur.
<p>(1.) Mobility of joint diminished, especially in certain directions.</p> <p>(2.) Foot and limb inverted and <i>fixed</i> (in the dislocation upwards and backwards), everted and <i>fixed</i> (in the dislocation upwards), and <i>fixed</i> in advanced position (in the dislocation downwards).</p> <p>(3.) Head of the femur felt in an abnormal position.</p> <p>(4.) Limb shortened or lengthened according to the direction of the dislocation.</p> <p>(5.) No crepitation.</p> <p>(6.) When dislocation is reduced, the bone remains in its place.</p>	<p>(1.) Mobility natural.</p> <p>(2.) Position of limb natural.</p> <p>(3.) Limb may be slightly lengthened.</p> <p>(4.) No crepitation.</p>	<p>(1.) Mobility of joint unaltered.</p> <p>(2.) Foot and limb everted, but can be forcibly inverted.*</p> <p>(3.) Limb shortened from $\frac{1}{2}$ an inch to 1 inch.</p> <p>(4.) Crepitation when the ends of the fractured bone are brought in contact, (this sign cannot always be detected).</p> <p>(5.) When the ends of the fractured bone are replaced, they do not remain in position unless some means are used to keep them so.</p> <p>(6.) This injury almost always occurs in old persons, or in those past the middle period of life.</p>	<p>(1.) Mobility of joint unaltered.</p> <p>(2.) Foot and limb everted, but can be forcibly inverted.*</p> <p>(3.) Limb shortened from 1 to 2$\frac{1}{4}$ inches.</p> <p>(4.) Distinct crepitation when the ends of the fractured bone are brought together.</p> <p>(5.) When the ends of the fractured bone are replaced, they do not remain in position unless some means be used to keep them so.†</p> <p>(6.) This injury most frequent in adults.</p>

* In rare cases the foot and limb are *inverted*.

† Should the fracture be an "impacted" one, the broken ends of the bone may be fixed.



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ABSTRACTS
OF
SURGICAL PRINCIPLES.

BY
THOMAS ANNANDALE, F.R.S. & F.R.C.S. (ED.)

— ♦ —
PART IV.
FRACTURES.



SECOND EDITION.

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P R E F A C E.

THESE Papers were originally printed solely for the use of gentlemen attending my Class of Systematic Surgery; but having been frequently requested to make them more public, I am induced to place them within the reach of the Medical Students of Edinburgh, with the sincere wish that they may be found an assistance in the study of some of the important principles of Surgery.

My object in preparing these Papers has been to give a concise abstract of the subjects treated of in a form intelligible to the youngest student.

It has certainly not been my intention that these Abstracts should take the place of more extended works on Surgery; but it is my hope that a study of them will promote a better understanding of such works and their contents.

THOMAS ANNANDALE.

ABSTRACTS OF SURGICAL PRINCIPLES.

FRACTURES.

*Terms in connection
with.*

Simple, when there is no external wound of the soft parts communicating with the fractured ends of the bone or bones.

Compound, when there is an external wound of the soft parts communicating with the fractured ends of the bone or bones.

Complicated, when the fracture is accompanied by another injury, such as a dislocation, rupture of an artery, &c.

Complete, when the entire thickness of the bone is separated.

Incomplete, when the entire thickness of the bone is not separated, as occurs in *fissures*, *bending*, or some *wounds* of bone.

Comminuted, when the bone is broken in more than one place.

Transverse, *Oblique*, *Longitudinal*.—

Terms—continued.

These terms are used to explain the direction of the line of fracture.

Crepitus or Crepitation.—These terms are applied to the grating sensation produced by rubbing together the broken ends of the bone or bones.

Impacted, when one fragment of the bone is driven into another portion, and fixed there.

Intra-capsular, when the line of a fracture occurring near a joint is situated within the capsular ligament.

Extra-capsular, when the line of a fracture occurring near a joint is situated external to the capsular ligament.

Separation of Epiphysis, when the epiphysis of a bone becomes separated from its shaft. This injury occurs in early life, before the epiphysis of a bone becomes completely united to its shaft, and is rarely met with after the age of sixteen.

Intra-uterine.—This term is applied to fractures of the bones of the fœtus “*in utero.*”

Causes of Fractures.

(1.) Predisposing.

(2.) Immediate.

(1.) *Predisposing Causes.*—These

Causes of Fractures
—continued.

consist of all causes, local or constitutional, which render the bones more fragile, or which lead to destruction of their tissue. Old age, rickets, cancer, syphilis, scrofula, caries, necrosis, and the absorption of bone, the result of the pressure of aneurisms or tumours, are usually classed as predisposing causes of fracture.

(2.) *Immediate Causes.*—External violence and muscular action.

External violence may produce a fracture—

(A.) Directly.

(B.) Indirectly.

General Symptoms of
Fractures.

Mobility of the bone where broken, crepitus, deformity, and impossibility of retaining the displaced fragments of bone in position, unless some retentive means be employed.

If the fracture is an *impacted* one, or an *incomplete* one, the mobility may not be marked, neither will there be such distinct crepitus.

In addition to the signs mentioned, there is usually pain, swelling, ecchymosis (appearing sooner or later after the injury), and interference with the

*General Symptoms—
continued.*

movements or functions of the part or organ with which the injured bone is connected. When important organs or cavities are implicated in a fracture, there will be signs of such implication, more or less marked, according to its severity.

*General Treatment of
Fractures.*

(1.) Bring the broken ends of the bone together as soon as possible. This is termed *setting* a fracture, and is best accomplished by relaxing all muscles which may be preventing the replacement of the broken bones, and by employing manipulation or *extension* and *counter-extension* of the part, by fixing one end of the broken bone, and extending the other, so as to get their broken surfaces together.

In order to relax the muscles implicated in the fracture, the position of the part must be attended to. A careful study of the attachments and connections of the different muscles will guide the surgeon in placing the part in the best position for relaxing those which are tending to produce the displacement of the fragments.

If the muscles cannot be sufficiently relaxed by position, chloroform may

*General Treatment—
continued.*

be administered for this purpose, or their tendons may in some instances be subcutaneously divided.

If there is much swelling and ecchymosis, it is usually better to wait for a few days before applying any firm bandage or apparatus. In such cases place the part in an easy position, support it with pillows, and apply fomentations to reduce the swelling.

(2.) When the fracture has been *set*, apply some apparatus which will retain the broken fragments in their proper place. Keep the injured part perfectly at rest, and place it in a position which will best restrain the action of any muscles that may act in displacing the bones.

The apparatus for treating fractures consists of bandages and splints of various forms. In using bandages or apparatus for the first time, great care must be taken not to apply them too tightly, and to examine their condition daily for some time in case of further swelling occurring after their adjustment.

Some of the fractures of the extremities, and more particularly those of

*General Treatment—
continued.*

the leg, may, when the swelling has diminished and the union is going on satisfactorily, be usefully treated by the application of an immovable apparatus, such as a starch or plaster of Paris bandage, which will permit the patient to leave his or her bed.

When the bone is simply *bent*, forcibly rebend it, and treat it as a case of fracture.

If the fracture is *compound*, stay any bleeding, *set* the fracture, apply proper apparatus to keep the bones in position, and endeavour to heal the wound as soon as possible, so as to convert the fracture into a simple one. If there should be loose fragments of bone, remove them; and if the bone should protrude and cannot be replaced, saw or nip off the protruding portion.

The most certain method of healing the wound of a compound fracture without serious suppuration, is the antiseptic plan of Mr. Lister. His plan consists in freely applying by means of a syringe a solution of carbolic acid in water (one of the acid to twenty or thirty in water) to the whole surface of the wound and ends of the broken

*General Treatment—
continued.*

bone, and then placing over the wound the usual antiseptic dressing of prepared muslin. The spray and antiseptic precautions must be carefully used at each dressing of the wound, and effectual means employed to provide a free drainage of all fluids from its deeper part. Another excellent method is to wash out the wound with the watery solution of carbolic acid, and then apply over it a piece of lint soaked in carbolic ~~acid~~ (1 to 20). The dressing of lint next the wound should not be disturbed, but carbolic oil should be applied every two or three hours, so as to keep the dressing constantly moist with a fresh antiseptic medium. The piece of lint next the wound may be allowed to remain on until the wound has quite healed under it, or until it has become merely a superficial sore, which may then be dressed with any simple dressing. If the carbolic solution and dressing or carbolic oil is not at hand, a pad of dry lint, soaked in the blood, should be applied over the wound, and allowed to remain, so as to endeavour to form an artificial scab.

oil

*General Treatment—
continued.*

In cases of severe compound fracture, complicated with injury to large blood-vessels, great destruction of the soft parts, or involvement of large joints, amputation must be resorted to, more especially if the injury has been caused by direct violence, and has acted on the whole or the greater part of the circumference of the limb.

Fractures, both simple and compound, may be followed by inflammation, suppuration, or mortification. These complications must be treated according to general principles.

In all cases of fracture, when union has taken place, the stiffness of the muscles, joints, and other tissues must be treated by rubbing, warm bathing, and regular passive movement.

In addition to all local treatment, the general health of patients suffering from fracture must be carefully attended to.

Union of Fractures.

This is accomplished through the agency of an exudation poured out by the blood-vessels of the injured bone, surrounding periosteum, and other soft textures. This exudation, which may be considered as lymph, varies in amount and in the extent of its effusion in

*Union of Fractures—
continued.*

different cases, and gradually becomes developed into bony matter, constituting what is termed the "*callus*."

The exudation in most cases becomes first developed into a nucleated or fibrous blastema, in which points of ossification form, and gradually spread, until the whole mass is converted into bone.

In rarer instances the exudation is first developed into perfect fibrous or fibro-cartilaginous tissue, which gradually undergoes ossification.

The "*callus*" may entirely surround the broken ends of the bone, forming a sort of ferrule, it is then termed "*Ensheathing callus*"; or it may be merely deposited between the broken ends of the bone, filling up any gaps or spaces which may separate them; in this case it is termed "*Intermediate callus*." The union of a fractured bone by means of *ensheathing* callus is not so common in man as that which takes place by *intermediate* callus. In some cases there is a combination of both, and, in rare instances, a fractured bone unites *immediately* without the formation of any callus. When the callus has become converted into bone (which is at

*Union of Fractures—
continued.*

first porous and cancellated in its texture), further changes take place. Any exposed medullary surface of the bone becomes covered by a layer of bone ; any sharp or prominent portions of bone become rounded off, or disappear by absorption ; the callus becomes further developed, so as to form an outer compact layer and an inner medullary or cancellated structure ; and lastly, any portions of the callus or old bone which may be preventing the continuance of the medullary canal or cancellated texture, are gradually removed by absorption, so that the structure of the fractured bone becomes perfectly natural, and shows little or no trace of the injury. In *compound* fractures, followed by suppuration, union is accomplished by means of granulations, which form on and around the fractured ends, and gradually undergo ossification, and also by ossification of the surrounding periosteum. In *compound* fractures, the wounds of which heal without suppuration, union takes place as in simple fractures.

The time required for a fractured bone to unite by osseous material

*Union of Fractures—
continued.*

varies much in different instances, and depends upon the age and state of health of the person, the bone affected, and the nature of the injury. The osseous union of a fracture may be *delayed*, or it may not take place at all, when the fracture is termed an "*ununited*" one.

*Causes which may
delay or prevent
Union.*

(A.) Local.

(B.) Constitutional.

Local.

- (1.) Movement of the fractured ends.
- (2.) Overlapping or separation of the fragments.
- (3.) Presence of a foreign body between the fragments.
- (4.) Any interference with the vascular or nervous supply.
- (5.) Inflammation, suppuration, or disease of the bone.

Constitutional.

- (1.) Old age.
- (2.) Scurvy.
- (3.) Fevers and all causes which tend to weaken the general system.

*General Treatment
of Non-union.*

(A.) Local.

(B.) Constitutional.

Local.

Proper adaptation of the fragments, and complete rest of the fractured ends by means of some immovable apparatus, such as a starch or plaster of Paris bandage.

Constitutional.

Proper attention to health and diet.

When these means fail, and the fracture remains ununited, the fractured ends of the bone may be sawn off with the aid of antiseptic precautions and dressing of the wound, the tissues between and round about the broken bone subcutaneously scraped or stirred up, or a metallic drill or wire may be passed through both fragments, and left there for a few weeks.

**Special Fractures. Fractures of
the Cranium.**

(1.) Vault.

(2.) Base.

Vault.

Symptoms of.

These fractures may be simple fissures, or they may be attended with

*Symptoms of—
continued.*

more or less displacement (usually downwards) of the fragment or fragments. Any of these fractures may be simple or compound. In simple fissures and fractures, without displacement of the fragments, there may be no symptoms, but in those cases where the fragments are displaced, or where there is a wound, the injury can be felt or seen. In any case, signs of concussion or compression of the brain *may* or *may not* be present. The latter may be caused by one or more portions of bone being displaced downwards on to or into the brain (such a fracture is termed a "depressed" one), by extravasation of blood on to the surface of the brain or its membranes, or into the substance of the brain, or by the presence of any foreign body.

Treatment of.

Keep the patient quiet, and if there is no wound and no symptoms of compression, do not interfere. If the fracture is a *depressed* and *simple* one, and the symptoms of compression do not soon become relieved, operate, in order to remove or raise up the displaced fragments. If there is a wound com-

*Treatment of—
continued.*

municating with the fracture, and the fracture is a *depressed* and comminuted or punctured one, operate at once, whether there are symptoms of compression or not.

*Base.**Symptoms of.*

Bleeding from the ears, nose, or mouth, or extravasation of blood into the cellular tissue of the eyelids, orbit, or back of the head and neck, a discharge of watery fluid from the ear, and more rarely from the nose. Paralysis of one or more of the cranial nerves, giving rise to more or less paralysis of the parts with which they are connected, and insensibility, stertorous breathing, and other symptoms of compression of the brain, which vary in intensity in different cases.

Treatment of.

Keep the patient perfectly at rest, and if he survives, endeavour to prevent inflammatory symptoms by the application of cold to the head, purging, and attention to diet.

Fractures of the Spine.*General Symptoms of.*

Fractures of the spine are, in the majority of cases, complicated by dislocation or displacement of the vertebræ,

*General Symptoms—
continued.*

and there is generally, therefore, pressure on or some injury to the spinal cord and its membranes.

A simple dislocation, or an uncomplicated fracture of the vertebræ, does sometimes occur, but it is the exception.

The symptoms of a fractured spine vary in different cases, and depend on the situation of the fracture, as well as on the amount of injury sustained by the spinal cord. In most cases of fracture of the spine there is paralysis (more or less marked) of the parts or organs supplied by the nerves connected with that portion of the spinal cord below the injury. Fractures of the upper portions of the spine, with injury to the cord, are therefore more serious than those of its lower third. In addition to the symptoms of paralysis, more or less displacement of the injured vertebræ can, in many cases, be detected.

When cases of fracture of the spine, attended with paralysis, survive more than a few days, emaciation, bed-sores, and inflammation and irritation of the bladder, are common results.

(1.) Cervical region.

(2.) Dorsal region.

(3.) Lumbar region.

Cervical.

Symptoms of.

A fracture (with displacement of the fragments), implicating any of the first three vertebræ, is usually immediately fatal. When the fracture is situated at a point between the third cervical and upper dorsal vertebræ, there is great difficulty of breathing, with paralysis, more or less complete, of the upper and lower extremities, bladder, and sphincter muscles of the rectum. An accumulation of gas takes place in the intestines, giving rise to tympanitis. There is usually some projection or displacement of the spinous processes at the situation of the injury. These injuries generally prove fatal in a few days. A few cases have, however, been known to recover.

Dorsal.

Symptoms of.

If the fragments are displaced, there is paralysis of the lower extremities, bladder, and rectum; and if the injury is in the upper part of the dorsal

*Symptoms of—
continued.*

region, the respiration will be more or less affected.

Irregularity or displacement of the spinous processes at the point of injury is in most cases present. Patients may recover from these injuries, but are liable to suffer from urinary irritation and bed-sores during their recovery.

Lumbar.

Symptoms of.

If the fracture implicates the upper lumbar vertebræ, there will be paralysis of the lower extremities, bladder, and rectum; but if the fracture involves only the lower lumbar vertebræ, these symptoms may not be present. In some cases the displacement of the vertebræ may be detected by touch and sight.

*Treatment of Frac-
tures of the Spine.*

Place the patient on his back, and support the spine as much as possible by means of pillows. If the bladder is paralysed, draw off the urine regularly two or three times a-day, and continue to do so until the bladder is able itself to expel its contents. Endeavour to avert the formation of bed-sores by preventing continuous pressure on the prominent portions of the body. In

Treatment of Fractures of the Spine
—continued.

order to do this effectually, water mattresses or pillows should be employed, and care should be taken to keep the patient's bed dry and clean, for the urine and feces may pass involuntarily. Lastly, support the patient's strength, and attend to his general health.

Fractures of the Bones of the Face.

- (1.) Nasal bones.
- (2.) Malar bones and upper jaw.
- (3.) Lower jaw.

Nasal bones.

In fractures of these bones the fragments may be displaced *backwards*, or to one or other side, and, consequently, give rise to alteration in the shape of the nose.

Considerable swelling often follows this injury, so that the displacement may be difficult to detect, if the case is not seen early.

Treatment of.

Endeavour to replace the fragments by manipulation, and by passing a pair of dressing forceps, or other similar body, into the nostrils, and using it to raise up the depressed bone. One or more pads of lint may then be applied,

*Treatment of—
continued.*

and secured with strips of sticking plaster, or with collodion, so as to keep the bone in position.

Symptoms of.

Malar bones and upper jaw.

A fracture of the malar bone is very rare, and is almost always complicated with a fracture or displacement of some portion of the upper jaw.

The upper jaw may be fractured through its body, or through some of its processes, either with or without displacement of the fragments.

The symptoms of all these injuries are the displacement of the fragments, and the consequent deformity and swelling of the face.

Treatment of.

Endeavour to return the displaced fragments to their proper position, and, if necessary, retain them there by pads and strips of plaster, or with collodion ; should the alveolar margin be involved, the fragments may be wired together.

Lower Jaw.

This bone may be broken through—

- (1.) Body (most common.)
- (2.) Angle.
- (3.) Ramus or neck (rare).
- (4.) Symphysis (rare).

The bone may also be broken on both sides, or at two different points on the same side. One or more of the teeth may be loosened or displaced, and there may be a wound of the mucous membrane, or of the external soft parts.

The line of fracture is most frequently *oblique*, but it may be *vertical*. In some cases it is limited to a portion of the alveolar margin, which may be displaced, or entirely separated, along with one or more teeth.

Symptoms of.

Displacement of the fragments, irregularity and displacement of the teeth, mobility, and crepitation.

When the fracture is through the neck, there is pain and difficulty in moving the jaw, crepitation, freer movement than natural, and, in some cases, deformity caused by the displacement of the fragments.

Treatment of.

Readjust the fragments, close the teeth, and fix the jaw by means of a paste-board or gutta-percha splint and bandage embracing the chin, and secured there. If this is not sufficient, apply a cap of gutta-percha over the teeth, so as to fix the broken ends of the bone,

*Treatment of—
continued.*

or drill the jaw and wire together the fragments. If any teeth or portions of bone are completely loosened, it is better to remove them. The patient should be forbidden to speak, and should be fed with fluids and soft food which require no mastication. Fractures of the jaw unite readily, in the majority of cases, in from three to five weeks.

Fractures of the Clavicle.

- (1.) Outer third.
- (2.) Middle third (most common).
- (3.) Inner third (rarest).

Symptoms of.

More or less depression of the shoulder and arm on injured side, displacement and overlapping of the fragments. (This is most marked in the fracture through the middle third. Fractures through the acromial and sternal ends are not usually attended by so much displacement.) Crepitation when the broken ends are pressed upon or moved against one another, and pain and difficulty in raising the arm. In fracture through the middle third, the inner fragment is usually drawn slightly up-

*Symptoms of—
continued.*

wards and forwards (by the sterno-mastoid muscle), the outer fragment being displaced downwards and towards the body owing to the weight of the arm and the action of the pectoralis major and subclavius muscles.

Treatment of.

Draw the shoulders backwards, and fix them so by a proper bandage. Support the arm and elbow by means of a sling, and secure the arm to the side by a bandage passed round the chest.

If possible, it is better to keep the patient lying flat upon his back for a week or two. In cases where there is no displacement, this is often sufficient without applying any apparatus. When the fracture is at the outer third, and there is only slight displacement, a pad placed over the fracture, and secured by a figure-of-eight bandage, or by plaster applied over the shoulder, often answers very well.

In children one or more broad strips of adhesive plaster should be placed over the fracture, so as to keep the ends in position, and the arm secured to the side, and supported by a bandage and sling.

Fractures of the clavicle unite in from three to four weeks.

Fractures of the Scapula.

- (1.) Body.
- (2.) Neck.
- (3.) Acromion process (rare).
- (4.) Coracoid process (rare).

Body.

Symptoms of.

Deformity, crepitation (which is best detected by placing one hand flat over the bone, and then moving the arm in different directions), and more or less pain and difficulty in the movements of the arm.

Treatment of.

Manipulate the fragments into position; if there is any displacement, place the arm in the position which best keeps them so, and then secure the scapula and, if necessary, the arm by a bandage passed round the chest.

Neck.

Symptoms of.

A depression under acromion, the head of the humerus, together with the glenoid cavity felt in the axilla, crepitus when the head of the bone is raised up into its place, and the arm

*Symptoms of—
continued.*

rotated, and when the head of the bone and glenoid cavity are raised into position, they do not remain so, but fall down again into the axilla.

Treatment of.

Raise the head of the humerus and glenoid cavity into their proper place, and adjust a firm pad in the axilla, so as to keep them there, support the arm with a sling, and secure it to the side with a bandage carried round the chest.

Acromion.

Symptoms of.

More or less depression of the shoulder and arm, with irregularity in the outline of the process and crepitus, when the fingers are placed on the fractured bone, and the arm raised and rotated. A separation of the epiphysis of the process appears to be more common than fracture.

Treatment of.

Support the arm by means of a sling, and, if necessary, adjust a pad over the fractured bone, so as to prevent any displacement.

Coracoid process.

Symptoms of.

This injury is most frequently complicated with fracture of the glenoid

*Symptoms of—
continued.*

cavity or other injury to the scapula, or with dislocation of the head of the humerus, and is diagnosed by the displacement downwards (owing to the action of the pectoralis minor muscle) of the extremity of the process, and by crepitus when the arm is raised and thrown across the chest.

Treatment of.

Flex the arm on the injured side, and bring it across the chest, so that the hand rests against the front of the opposite shoulder, and secure it so by means of a bandage, taking care at the same time to support the elbow.

Fractures of the Humerus.

- | | | |
|----------------|---|---|
| (1.) Neck. | { | (A.) Through anatomical neck.
(B.) Through surgical neck.
(C.) Separation of the epiphysis. |
| (2.) Shaft. | | |
| (3.) Condyles. | | |

Anatomical neck (very rare).

The line of this fracture may be entirely within the capsular ligament (*intra-capsular*), or partly *intra-cap-*

Symptoms of.

sular, partly *extra-capsular*. The broken bones may be *impacted* or *non-impacted*.

Slight depression under acromion ; no displacement of the head of the bone, crepitus when the head of the bone is pressed against the glenoid cavity and rotated (if the fragments are impacted, crepitus may not be detected), and the mobility of the joint natural. When the head of the bone is driven into the neck between the tuberosities, the arm is usually slightly shortened.

Treatment of.

Support the arm in a sling, and keep it at rest. No other apparatus is necessary.

Surgical neck (most common).

This fracture may be *impacted*, or *non-impacted*.

Symptoms of.

Slight depression about an inch below acromion, with projection of the lower fragment upwards towards the coracoid process (the amount of the displacement varies in different cases, and displacement in a direction towards the axilla or outwards has been observed). The head of the bone

*Symptoms of—
continued.*

is in the glenoid cavity, but does not move with the shaft, and there is crepitus, when the fragments are brought together by extending the arm. In the majority of cases the arm is shortened.

When the fracture is impacted, the symptoms will be slight; there will be some alteration in the roundness of the shoulder, and some shortening of the arm. There will be no very distinct crepitus, and the head of the bone will move with the shaft.

The upper fragment is slightly drawn upwards by the action of the muscles attached to the tuberosities. The lower fragment is drawn upwards and inwards by the muscles inserted into the bicipital groove (pectoralis major, latissimus dorsi, and teres major), and the arm may be thrown outwards from the side by the deltoid.

Treatment of.

Adjust the fragments by extension, flex the elbow, and apply a splint of pasteboard or gutta-percha which will cover the shoulder, extend down the outer and inner aspects of the arm, and include the elbow, and suspend the forearm and hand in a sling, so as to

*Treatment of—
continued.*

allow the elbow to hang down unsupported.

Symptoms of.

Separation of the epiphysis.

This injury is only met with before the age of 20, and is characterised by increased mobility, by the head of the bone being in the glenoid cavity, but not moving with the shaft, by the projection of the lower fragment in front (this projection is not so pointed or marked as in fracture of the surgical neck), and by crepitation, which is not so distinct as in an ordinary fracture.

Treatment of.

The same as in fracture of the surgical neck.

Symptoms of.

Shaft.

These may take place at any point, most frequently about the middle. The symptoms are increased mobility, deformity, and crepitation when the broken ends are brought in contact. When the fracture is above the insertion of the deltoid muscle, the lower fragment is drawn upwards and outwards by the action of this muscle, and the upper fragment is drawn inwards by the pectoralis major, latissimus dorsi, and teres major.

*Symptoms of—
continued.*

When the fracture is immediately above the condyles, the fragments are usually much displaced, and this accident and a similar one (separation of the epiphysis), which is common in children, simulate very much in many cases a dislocation of the ulna and radius backwards. In these injuries the lower fragment is usually displaced backwards and upwards. The symptoms of this fracture are, that the olecranon and head of the radius together with the condyles or lower fragment project behind, but their relation to the condyles is not altered. If the displaced bones be reduced, they do not remain so, and crepitus is felt when the displaced fragments are brought into contact.

Treatment of.

Bring the broken bones into position by extension and counter-extension, flex the elbow, and apply splints of wood, pasteboard, or some other substance, so as to embrace the arm and keep the fragments in position. The arm should then be well supported in a sling with the elbow flexed.

In fractures above the condyles, or in separation of the epiphysis, the arm

*Treatment of—
continued.*

should be well flexed, the fragments manipulated into position, and kept so by means of two firm pads, one being placed over the front, the other over the back, of the elbow, and secured by a figure-of-eight bandage. Should these means not be sufficient to keep the broken bone in position, apply angular lateral splints so as to embrace the elbow, lower half of the arm, and upper half of the forearm. The arm should be well supported in the flexed position by means of a sling, and at the end of two or three weeks careful movements of the joints practised to prevent ankylosis.

Condyles.

Symptoms of.

A fracture may pass obliquely through the condyles into the joint, or it may merely separate one of these processes.

All these injuries are distinguished by more or less displacement of the fragments and by crepitation when the joint is moved.

Treatment of.

These injuries are best treated by manipulating the fragments into position, and securing the arm in the flexed

*Treatment of—
continued.*

position, and at the end of two or three weeks practising careful movements of the joint.

Fractures of the humerus take from four to five weeks to unite, but when situated near the articulations, careful movements should be practised before this time.

Fractures of Radius and Ulna.

- | | |
|----------------------------|---|
| (1.) Radius. | { (A.) Of neck (very rare).
(B.) Of shaft (most common through lower third). |
| | |
| (2.) Ulna. | { (A.) Of olecranon.
(B.) Of coronoid process (very rare).
(C.) Of shaft. |
| | |
| (3.) Both radius and ulna. | |

Radius.

Symptoms of.

A fracture through the neck of this bone is very rare, and is not easily detected.

Shaft.

A fracture through the upper or middle third of the shaft below the insertion of the biceps is distinguished

*Symptoms of—
continued.*

by deformity and crepitation. The upper fragment is displaced upwards and forwards (by the biceps and pronator teres), the lower fragment is drawn towards the ulna (by the pronator quadratus).

Fracture through the lower third (Colles' fracture) is very common, and is distinguished by the following symptoms:—A projection on the back, and a corresponding hollow on the front, of the wrist (caused by the displacement of the lower fragment), the hand displaced towards the radial aspect, the lower end of the ulna prominent, and crepitation when the fragments are brought into contact and moved. In some cases the fragments are more or less impacted, so that crepitus may not be easily obtained.

Treatment of.

Flex and supinate the forearm, adjust the fragments, by extending the hand, and by manipulation, and apply a splint along the outer and inner aspects of the forearm and hand. The splints should be carefully padded, so as to fill up any of the inequalities in the line of the forearm and hand.

In the fracture through the lower

*Treatment of—
continued.*

third, the portion of the splint confining the hand should be removed in about a fortnight, and careful movements of the wrist and fingers practised, otherwise the joints will become stiff.

Ulna—Olecranon.

Symptoms of.

Mobility and crepitation when the process is laid hold of and moved, and more or less separation of the fragments (the upper fragment being drawn upwards by the triceps). In some cases there is little or no separation, while in others the ends may be separated an inch or more; in the latter case crepitus will only be detected when the fragments are brought into contact by extending the arm.

Treatment of.

Extend the arm and apply a straight wooden or other splint to the front of the elbow, so as to keep the forearm in the extended position. In applying the bandage, draw the fragments as closely together as possible, by means of a few figure-of-eight turns.

Coronoid process.

This injury is very rare, and is generally associated with a dislocation

	backwards of the bones of the forearm.
<i>Treatment of.</i>	Secure the arm in the flexed position.
	<i>Shaft.</i>
<i>Symptoms of.</i>	This portion of the ulna may be broken at any point. The symptoms are deformity (usually slight), mobility and crepitation when the ulna is laid hold of and the two fragments brought together. The lower fragment is generally displaced inwards.
<i>Treatment of.</i>	Apply splints as in fracture of the radius.
	<i>Radius and ulna.</i>
<i>Symptoms of.</i>	When both these bones are fractured, it is usually through their middle or lower third. The symptoms are well-marked deformity, increased mobility, and crepitus.
	The upper fragments of the radius and ulna are tilted slightly upwards (by the action of the biceps, pronator teres, and brachialis anticus muscles), the lower fragments are drawn together (by the pronator quadratus muscle).
<i>Treatment of.</i>	Adjust the fragments by extension and counter-extension, flex and supi-

*Treatment of—
continued.*

nate the arm, and apply wooden or other splints as in fracture of the radius.

Fractures of the bones of the forearm unite in from three to four weeks.

Fractures of the Carpal, Metacarpal, and Phalangeal Bones.

Carpus.

Simple fractures of the *carpal* bones are rare, most frequently they are compound, and attended with displacement and laceration, or destruction of the soft textures. The treatment will consist in removing any loosened or displaced fragments, and keeping the hand at rest, provided the complications do not require amputation.

Meta-Carpus.

The *metacarpal* bones of the thumb and fingers may be broken through any part of their shaft (most frequently through their middle or distal third), and, occasionally, through their articular extremities. The fragments may be displaced or remain in position.

Symptoms of.

The symptoms of this injury are deformity, pain, crepitus, and mobility.

Treatment of.

Apply a bandage round the hand, and keep it at rest ; if there is any displacement, press the bones into their place, and apply a pad over them to keep them in position.

Phalanges.

The *phalangeal* bones, especially the *first* ones, may be broken (generally through the middle, occasionally through their extremities). Compound fractures of these bones are very common.

Symptoms of.

The symptoms are deformity and crepitus, with increased mobility.

Treatment of.

Simple fractures of the first phalanx may be treated by placing a pad (such as a cork or rolled-up bandage) in the palm of the hand, firmly flexing the injured finger over it, and securing it in that position with a bandage, or by a splint applied to the palmar aspect of the finger in the extended position. Fractures of the other phalanges should be treated by applying a narrow wooden pasteboard or gutta-percha splint along their palmar aspect.

Fractures of the carpal, metacarpal, and phalangeal bones unite in from

*Treatment of—
continued.*

two to three weeks; but, when situated near a joint, careful movements of the joint should be practised at the end of ten days or two weeks.

Fractures of the Sternum and Ribs.

Sternum.

Fractures of this bone are rare. Any of its different portions may be merely separated, or they may be broken. There may or may not be displacement, complicated with injury, to the contents of the mediastinum.

Symptoms of.

The symptoms are deformity, crepitus, and in cases attended by injury to the contents of the chest, there will be signs of such injury, more or less marked, according to its nature.

Treatment of.

Keep the patient on his back, apply a bandage round the upper part of the chest, and treat any complications by proper means.

Ribs.

These bones may be broken on one side of the chest only, or on both sides; they may be broken at one point, or at several points. The fracture may be

simple, or it may be complicated with injury to the contents of the chest or abdomen ; or, again, there may be an external wound communicating with the injured bone or bones. The ribs most frequently fractured are the 4th, 5th, 6th, and 7th. The first three ribs, owing to their depth, and the last ribs, owing to their mobility, being rarely injured.

The ribs may be broken through their anterior, middle, or posterior third ; sometimes through more than one of these.

Symptoms of.

In simple fractures there is pain, difficulty in respiration, and crepitus felt when the hand is placed over the injured part, or heard by applying the stethoscope. Sometimes the patient himself feels the crepitus when he coughs or breathes.

When the pleura or lungs are implicated, there is emphysema, expectoration of blood mixed with air, and an irritating cough, and if other organs or structures (thoracic or abdominal) are injured, there will be the signs of such implication present.

Treatment of.

When the fracture is simple, keep

*Treatment of—
continued.*

the patient in bed, and apply a broad bandage round the chest, or a broad strip of plaster may be adjusted over the injured part.

When complications exist, or arise in the progress of the case, they must be treated by proper means. If there is expectoration of blood, give ice and other cooling drinks; and if symptoms of inflammation of the lungs or other organs appear, treat them according to general principles.

Simple fractures of the ribs unite in from two to three weeks.

Fractures of the Pelvic Bones.

The ilium, ischium, pubis, sacrum, and coccyx may be fractured, the two latter bones rarely. The fracture may be combined with a dislocation or separation of some of the bones, or it may involve more than one of the pelvic bones, or the same bone may be broken at more than one point. These injuries may be of a simple nature, or may be complicated with injury to the bladder, urethra, or other contents of the pelvis, or laceration of the external soft textures. The simplest kind of

Symptoms of.

fracture is that which merely involves the expanded portion of the ilium. The acetabulum is sometimes broken through its base, at other times a portion of its brim only is fractured. Such injuries may or may not be attended with a dislocation of the head of the femur.

When the fracture is simple, crepitation will be felt if the pelvic bones are grasped and moved, and in some instances displacement of the bones will be apparent.

Should the bladder or urethra be torn or injured, blood will be passed by the urethra, and there will be other signs of implication of these structures, such as swelling, extravasation of urine, and if the bladder is injured, peritonitis. Simple fractures of the pelvic bones are, however, not always easily detected, owing to the difficulty of obtaining crepitus.

Treatment of.

Keep the patient on his back, apply a bandage round the pelvis, and treat any complications by proper means. If the urethra or bladder is torn, introduce a catheter; and if extravasation of urine takes place, make free incisions into the parts affected.

Fractures of the Femur.

- (1.) Neck. { (A.) Intra-capsular.
 { (B.) Extra-capsular.
(2.) Shaft.
(3.) Condyles.

Neck.

This portion of the femur may be broken entirely within the capsular ligament ("Intra-capsular"), entirely external to it ("Extra-capsular"), and occasionally partly within and partly external to it. The fragments may or may not be entirely separated. Sometimes they are impacted. The line of fracture may be transverse or more or less oblique.

*Intra-capsular.**Symptoms of.*

Usually met with in persons above fifty years of age. Shortening of the limb from $\frac{1}{4}$ an inch to 1 inch, eversion of the foot (in a few rare instances inversion has been present), the trochanter major drawn *slightly* upwards and backwards (by the action of the gluteal and external rotator muscles), crepitation when the hip is rotated (this symptom is not always to be de-

*Symptoms of—
continued.*

tected, and pain when any attempt is made to remove the injured limb. An important fact in connection with this injury is, that the symptoms at first may be very slight or scarcely present, but may become well marked in a few hours, or even not for one or more days after the injury.

Treatment of.

Place the patient on his back, gently draw the limb into its proper position, and then either apply extension by means of the weight or support the limb with pillows in a way which will not only be comfortable to the patient, but which will keep the bones at rest. These fractures do not unite by bone, but by fibrous tissue. When they occur in old or weak patients, they may cause death by irritative fever and exhaustion. In favourable cases, patients may, after recovery, be able to use the injured limb, which, however, always remains shortened. In other cases, absorption of the neck of the bone takes place, and causes great deformity and lameness.

Extra-capsular.

This fracture most frequently takes

place obliquely through the trochanters. It is often comminuted, and the fragments may be more or less impacted (the upper fragment almost always penetrating the lower one).

Symptoms of.

Often occurs under the age of fifty. Shortening of the limb (the amount of this depends on whether or not the fracture is impacted). In the former case the limb is shortened from $\frac{1}{2}$ an inch to $1\frac{1}{2}$ inches; in the latter from $1\frac{1}{2}$ inches to 2 inches, or even more; eversion of the limb (in rare cases inversion), increased mobility, crepitation (usually distinct), and displacement of the trochanter major.

Treatment of.

Draw the limb into position and to its proper length, and then apply the extension and weight or the long splint.

This fracture unites by bone, generally, however, with some shortening of the limb. The union takes place in from six to eight weeks.

Shaft.

This portion of the bone may be fractured through its upper, lower, or middle third; the latter is much the most common. The direction of the

Symptoms of.

fracture is most frequently oblique, but it may be transverse (especially in children).

Shortening and deformity of the limb, increased mobility, and crepitation when the fractured ends of the bone are brought in contact.

In the majority of cases, there is displacement or overlapping of the fragments, which varies in amount in different instances.

In fractures of the upper third of the femur, the upper fragment is displaced *forwards* and *outwards*, and the lower fragment *inwards*.

In fractures of the middle third, the displacement of the fragments is much the same as in the upper third.

In fractures of the lower third, the fragments are usually displaced laterally according to the direction of the line of fracture (in the majority of cases, the upper fragment is anterior to the lower); and if the fracture is immediately above the condyles, the lower fragment is drawn backwards (by the action of the gastrocnemius).

Treatment of.

Adjust the fragments, by extension and counter-extension of the limb, and

*Treatment of—
continued.*

then apply splints, which will effectually keep the fragments in position, and, at the same time, keep at rest the principal articulations of the lower extremity. The best splints for treating a fracture of the shaft of the thigh are two or more wooden "gooch" or pasteboard splints, of sufficient length and width to surround the whole thigh and knee, and a long thigh-splint, which will reach from the middle of the chest above to five or six inches beyond the ankle below. The "gooch" splints, carefully padded, should first be applied accurately to the thigh, and secured by loops of bandage, and then the long thigh-splint adjusted to the outer side of the limb, and secured by means of a sheet or bandage. Instead of applying the long thigh-splint, extension, by means of the weight, may be adjusted to the limb after the "gooch" splints have been secured. I myself prefer this latter method.

Most fractures of the thigh are best treated with the limb in the extended position.

The principal exceptions to this rule are—(1st), Those fractures immedi-

*Treatment of—
continued.*

ately above the condyles, with displacement backwards of the lower fragment. Such cases are best treated by fixing the limb in a flexed position, so as to relax the gastrocnemius muscle.

(2nd), When the knee or hip joint is anchylosed in a flexed position, owing to former disease or injury. In these cases it is impossible to extend the limb, and so they must be treated as well as possible in the flexed position.

Condyles.

This injury may consist of a separation of the epiphysis (in young persons), or of a transverse or oblique fracture through the condyles, with or without implication of the joint.

Symptoms of.

Crepitus, when the joint is moved, and some deformity or displacement of the bones. If the joint is involved, there may be considerable effusion into it, causing swelling and stiffness.

Treatment of.

Adjust the fragments, and secure the limb in the extended position. After a month or five weeks, careful movements of the joint should be performed to prevent or lessen the resulting stiffness.

*Treatment of—
continued.*

Fractures of the femur unite in from seven to nine weeks in the adult, and from three to five weeks in children.

Fractures of the Patella.

Fractures of this bone may be transverse, more or less oblique or vertical, or comminuted.

Symptoms of.

When the fracture is transverse, the upper fragment is drawn upwards (by the action of the extensor muscles). In vertical, oblique, or comminuted fractures, the displacement of the fragments is usually slight.

The symptoms of these injuries are more or less separation of the fragments, crepitus, and deformity.

Treatment of.

Relax the extensor muscles of the thigh by raising the whole limb, and slightly flexing the thigh upon the abdomen. Adjust the fragments by means of a bandage or other apparatus, and fix the limb on an inclined plane, which will keep the limb raised, and so relax the extensor muscles. This fracture rarely unites by bone; but it is of consequence, especially when the direction of the injury is transverse, that the ligamentous union be as short

*Treatment of—
continued.*

as possible. This bone unites in from four to five weeks, after which time careful movements of the limb should be practised.

Fractures of the Tibia and Fibula.

- (1.) Tibia.
- (2.) Fibula.
- (3.) Both Tibia and Fibula.

Tibia.

When this bone alone is fractured, the injury most frequently affects its middle or upper third, more rarely its lower third.

Symptoms of.

Deformity and crepitus, when the bone is grasped, and the two fragments moved against one another. There is rarely much displacement in this injury when the fibula remains entire. In rare instances the fracture may involve the knee or ankle joint. Sometimes the injury is confined to the internal malleolus.

Treatment of.

If there is no displacement, keep the limb at rest by the application of simple wood or pasteboard splints, or by securing it on a pillow.

When there is displacement, adjust

*Treatment—
continued.*

the fragments and secure the limb with splints in a position which best keeps the ends of the bone in position.

Fibula.

This bone may be fractured at any point; but it is most frequently broken through its lower third (Potts' fracture), and is then usually accompanied by a rupture of the internal lateral ligament of the ankle joint, with displacement or dislocation of the foot.

Symptoms of.

When there is no displacement, crepitus and increased mobility can usually be detected by laying hold of the malleolus with one hand, and with the other grasping the fibula above the injury, and thus moving the bone.

In cases where there is displacement of the foot, crepitus can usually be detected when the foot is brought back to its proper position.

Treatment of.

If there is no displacement, keep the limb at rest on a pillow.

If the foot is displaced, apply a splint on that aspect of the limb which will best permit of the foot being drawn into its proper position and retained there.

Both Tibia and Fibula.

These bones may be broken at any point, most frequently through their lower or middle third. The bones are not often fractured on the same level, the fibula being generally broken at a higher level than the tibia. These fractures are most commonly oblique; when transverse, they are usually situated at the upper or lower third of the bones.

Symptoms of.

Mobility, crepitus, deformity of the leg, and displacement of the fragments.

In transverse fractures there is usually little displacement, but in oblique fractures there is always some overlapping. In fractures of the middle and lower third, the lower fragment is usually displaced upwards and backwards, and to one or other side, the upper fragment projecting in front.

When the fracture is through the lower third, it may be accompanied by displacement of the foot.

Treatment of.

Adjust the fragments by extension and counter-extension of the limb, and then apply splints, which will effectu-

*Treatment of—
continued.*

ally keep the ends of the broken bones at rest and in position.

The bones of the leg unite in from six to eight weeks.

In treating fractures of the bones of the leg, the limb should be placed in the position which is most convenient, and which best keeps the ends of the fractured bones together. Thus some of these injuries are best treated in the semi-flexed, others in a slightly flexed, and others again in the extended position. Any form of splints may be employed, provided they are efficient; the simpler they are the better.

When there is little swelling and no complication, a plaster of Paris or starch bandage may be usefully applied from the beginning, so as to allow the patient more freedom of movement.

Fractures of the Tarsal, Metatarsal, and Phalangeal Bones.

Tarsus.

The os calcis, astragalus, and more rarely the other tarsal bones, may suffer a simple or compound fracture. Simple fractures of these bones are, however, by no means common. Such

injuries may be attended with displacement of the fragments, or there may be little separation of the broken portions. In complete fractures of the os calcis, when the line of fracture is behind the astragalus, the posterior fragment may be drawn upwards (by the muscles connected with the tendo achillis).

Symptoms of.

Deformity of the foot, crepitus, and displacement of the fragments.

Treatment of.

Adjust any displacement, and keep the foot at rest by securing it to a pillow, or by applying a pasteboard or gutta-percha splint, moulded so as to fit the injured portion, and keep the broken bones in their place.

In fractures of the os calcis, attended with displacement upwards of the posterior fragment, the leg must be secured in the flexed position so as to relax the muscles of the calf.

Metatarsus and Phalanges.

Simple fractures of these bones are not common. They resemble in their symptoms, and require the same treatment as, fractures of the metacarpal and phalangeal bones of the hand.

**Compound and Complicated Fractures
of the Bones of the Extremities.**

The symptoms and treatment of the various fractures of the bones of the extremities have been described principally as they are met with of a simple nature.

Compound and complicated fractures of these bones frequently occur, and must be treated according to the general principles already referred to.

Amputation will, in the majority of cases, require to be performed when the injury is severe, when the principal blood-vessels and nerves are injured, when large joints are implicated, and when there is much bruising, laceration, or destruction of the soft texture, more especially if these complications are the result of *direct* injury.

In treating compound fractures of the limbs, it should be remembered that injuries of the upper extremity are more favourable for recovery than similar injuries of the lower extremity, and also that young people, if they survive the first attacks of the accident, recover from these injuries much more readily than adults.

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